

I/O News

Volume One, Number Six

NEW ENHANCEMENTS TO CROMIX**ENCODE/DECODE FOR BASIC****COMANDER I****The OFFICIAL PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF CROMEMCO USERS**

Slidemaster and Fontmaster Join The Master Series

Cromemco Introduces New Graphics Products

At the Siggraph convention held in Dallas this August, Cromemco announced several new products to expand the capabilities of its high-resolution color graphics system. These include new user-oriented software to allow the non-programmer to compose and edit graphics displays, new software to support three SDI interfaces in a single system, and a camera adapter so that users can take photographs from the screen of their RGB monitor.

Slidemaster is the name of the new software package which interfaces a Summagraphics digitizing tablet to the SDI graphics system. By using a stylus with this digitizing tablet a user can draw pictures and edit them, working from a menu of 75 design functions. These design

functions include a selection of pen and brush sizes and shapes (including an "air brush" function), a color pallet, a selection of geometric building blocks (lines, circles, ellipses), and the ability to rotate, zoom, and pan images on the screen. Once a display has been created it can be stored on disk and then displayed in "slideshow" fashion, moving forward and backward through a sequence of "slides" at the touch of a key.

While the Cromemco SDI graphics package and the Slidemaster package provide a standard character set, sometimes there is a need for different fonts. This feature may be used for effect when labeling a display. Or there may be a need for a special set of characters in a non-

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Computers in Architecture

By William M. Henderson

As a profession, architects have only recently begun to accept the computer as an everyday tool which can improve their productivity and management. There are good reasons for this. The typical architectural firm is a small office of 8 people or less. Until very recently there was no inexpensive computer system available with proven, professional software which would justify the expense for the small office. A November, 1980 survey showed that only 30% of all architectural offices surveyed had any kind of word processing or other automation, including memory typewriters.

The typical architectural firm, no matter how small, cranks out reams

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Track Your Investments with Easy COBOL Program

By Peter J. Polini

Micros and COBOL

It's common to see only programs written in BASIC in the variety of micro magazines. Perhaps this is because many micros on today's market cater to this language or because of limited core requirement. But with the advent of new micro lines and expansion of RAM on existing micro computers, many manufacturers are now offering a language very new to micro users: COBOL.

I have found during my years in data processing and, most recently,

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Michele Burgan of Cromemco is shown using Slidemaster to compose a bar chart on the screen of an RGB monitor.

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that
important
hard
disk
file?



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I/O News

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Richard Kaye
Editor and Publisher

Lynn Platzek
Editorial Assistant

Member Questions Loyalties of IACU

Dear Editor:

In the May/June issue of *I/O News*, a letter from John D. Hurni states: "But as an 'Association of Users' I think I expected something additional in the area of critical review and analysis. Now I appreciate the desire not to develop an adversary relationship with Cromemco — that's good. Please do your best to maintain it. However, couldn't we develop a balanced relationship with Cromemco in which there is freedom to talk about the shortcomings and limitations of our systems?"

In a telephone conversation with you on Friday, July 24th, you mentioned that you were aware of an unpredictable, erratic problem that appeared to occur on a small number of 64KZ boards, but you had made no mention of this in *I/O News*, although you were certainly willing to tell people who spoke to you that you knew about it.

You said that you had not published anything about this for fear of creating

memco. While it is clear that there is a large area of overlap in the community of interests held by Cromemco, *I/O News*, and the users, it appears to me important for *I/O News* to recognize that at least formally, it would be desirable for it to play a protagonist role with respect to the users, and hence, equally formally, an antagonist role with respect to Cromemco. It is certainly helpful to me to be kept apprised of the new and good things that Cromemco is doing. However, to the extent, that you, editorially, are not providing the users with information that, while available to you, may be construed as reflecting poorly on Cromemco, you are doing a disservice to at least this member of your paid constituency (sic).

Sincerely yours,

Peter Zilahy Ingerman
SYSTEMS CONSULTANT
Willington, New Jersey

Dear Mr. Ingerman:

You bring up several points which are most appropriate at this time. As you know, this issue marks the end of our first publication year, and perhaps this is an ideal moment to review our purposes and our policies.

We see ourselves as a communications center — a two-way communications center — that acts as a clearing house for information sent us by members. Of the two examples of areas where you suggest we could have done a better job, the first dealt with Cromemco's 64KZ boards. Even though we have, as you indicated, been aware of some problems, you are the first person to write us asking to have the subject aired. Most people who have called us expressing concern, have been looking for solutions to their specific problems. These we have tried to provide. So, rather than hiding the problems, we have been more concerned with helping find the solutions. Now that you have raised the issue, we can say that it is true that some 64KZ boards have been troublesome — especially when converted to use from CDOS to CROMIX. Cromemco had a devil of a time solving the problems, and finally went to a different supplier of sockets for these boards. This seems to have been the answer, as our calls on this subject have diminished to practically none.

The second example you offered dealt with 32K Structured BASIC. You suggested that while this is undoubtedly excellent software, you would be surprised if there were not some known bugs. You also asked why we have not published a list of such bugs. Good points, all.

Yes, there are some documented bugs. In fact, Cromemco just published a book

described as "A compilation of Cromemco Software notes for use by Cromemco Dealers in support of Cromemco Software Products." The manual is called, appropriately enough, "CROMEMCO SOFTWARE NOTES." It has been shipped to all active Cromemco dealers for their use in aiding their customers in identifying and circumventing bugs which exist, not only in 32K SBASIC, but in other software as well.

The reasons we have not yet published excerpts from this book are twofold. First, it just came out (we received our copy in July), and, second, the index indicates there are 23 pages devoted to 32K Structured BASIC. We simply do not have the space available to re-publish this book.

The best way to see if a specific software note has been documented in the book is to go to your local dealer and ask to see his copy. Also, you may want to check with your dealer periodically, as the book is scheduled to be revised and expanded quarterly.

Overall, your letter has given us cause to review our role in the total scheme of things. Our relationship with Cromemco, and our relationship with the members are both very important to our continued existence. But words like "adversary" and "protagonist" probably have little bearing on how we function. Remember, we structured ourselves as a communications center, an information clearing house, not as ombudsmen.

As you pointed out, we do stress the new products and offerings from Cromemco. We do this on the basis that many users plan to expand their systems and/or usages, and information as to new products helps them in their planning. Also, it would be difficult for me to come up with the names of any successful magazines that dwell on the negatives of their respective subjects. So, we do expend more space on the positive aspects of our basic subject matter. That way, hopefully, we will be around for a long time.

Thank you for your comments. Perhaps others will share their views on this subject.

R.L. Kaye, Editor

input...

a problem where none had existed.

I suggest that Hurni has made a point that I would like to reiterate: this is a users' group, and its principle obligation should be to the users. If there is, for example, an intermittent problem with a small number of 64KZ boards, it is reasonable for me to know that — not to dissuade me from purchasing a 64KZ board, but rather to be sure that if I do, I know beforehand I should make it clear with my dealer that if this board develops a problem I will expect it to be replaced without argument...

As another example, in your response to Hurni you recommend the 32K Structured BASIC. While, on the one hand, not doubting that 32K Structured BASIC is an excellent product, on the other hand, I should be surprised if there were not some known bugs out against it; what are they and why was there not a published list of them, so that Hurni would be in a position to judge whether it would, in fact, satisfy his needs beyond those expressed in his letter?

I suggest that I have given you two instances of areas where *I/O News* has, in my opinion, erred on the side of being too conciliatory with respect to Cro-

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Watch Out!

A few weeks ago, Richard Quinn, the owner of QUINTEC and author of the popular column, Tec Tips, moved his service company into a newer and larger shop. But, while he was still moving in, and before he had finalized the proper insurance coverage for his new location, he was burglarized.

The thieves stole some \$80,000 worth of equipment — tools, test equipment, boards. That's right, boards. They opened his computers and took out the boards. Then they looked around until they found the supporting software and documentation, and stole that, too. They were definitely pros, and they knew exactly what they were doing. No fingerprints were found.

This would have been a disastrous story but for Quinn's customers. They rallied around the likeable guy offering him money (extended credit), tools and equipment, and especially more business. In fact, business has never been brisker. So, this story is not intended to be a tear-jerker on behalf of Quinn. He's up and running, and within

output ...

two years will have worked his way back to where he was. Maybe sooner.

No, this story is a warning. A warning to everyone who has a computer. Watch it, folks. There is a new class of very sophisticated thieves out there. And there is something we — all of us — can do about it. Toward the end of this article are descriptions and serial numbers (where available) of the equipment stolen from Quinn. If anyone, anywhere, offers to sell you some used equipment, arrange a meeting. (Better have a cop with you.) If it is stolen equipment, nail 'em. Right there on the spot. **THE ONLY WAY TO STOP THE THEFT OF COMPUTER EQUIPMENT IS TO PROVIDE NO MARKET FOR RESALE.**

Let's face it. Even if you really need a new board to upgrade your system, and even if the price is so attractive that you really are tempted, remember this: If it's stolen equipment, and if the thieves sell it to you, they'll probably discover where your equipment is located. Guess what? You'll be next. Because that's the way they operate. So, when we implore you to help stop this practice, do it. It's in your own self-interest.

Incidentally, if you ever experience a loss of this type, there are a few things you can do. First, write to the Manager, Repair Department at Cromemco with a list of the serial numbers. (You do have yours recorded and stored in a safe place, don't you?) Cromemco maintains a separate file of serial numbers on stolen equipment. If it ever turns up for repair, it can be cross-checked against the list, possibly resulting in a recovery of your loss.

Second, contact all the dealers in your area with the same list and for the same reasons.

Third, write us. We will publish the descriptions and numbers. I/O News makes this pledge: we will devote whatever space is necessary to curtail thefts by listing serial numbers, and by rallying every Cromemco user to aid all his fellow users in providing no resale outlet to the thieves.

In addition, we have already started researching insurance companies to determine what coverages are available, at what prices, and how we can obtain favorable rates for IACU Members. These topics will be covered in future editorials.

The items stolen from QUINTEC Services, Inc. on June 28/29, are:

COMPUTER CIRCUIT CARDS

8 ea — 16k Memory Cards, 7 Cromemco 16KZ, 1 Manufacturer unknown. 5 cards assembled from kits, therefore have no serial nos. 4 cards labeled with A-D on the Cromemco logo. Card "D" has 6 position switch replacing normal 4 position address switch. Switch #6 used to deselect card for use in memory address C000H. 2 cards Cromemco factory assembled, serial nos. unknown. One of the two is jumper for use in 64k system, address C000H. 1 Card not Cromemco, manufacturer unknown, serial number unknown. Card hard wired for use in memory address 8000H.

2 ea Cromemco WDI disk controller cards. Serial nos. unknown. One card has Z80-PIO chips with orange spots over pin 1.

2 ea Cromemco 4FDC floppy disk controllers. 1 card assembled from kit without serial number. Card has date assembled marked on reverse side in black. 1 card factory assembled. Serial no. unknown. Both cards are modified on the reverse side for use with double sided drives.

2 ea. Cromemco TU-ART's, 1 card assembled from kit without serial number. There are at least two etch repairs on the circuit side using small wire. 1 card new, serial number unknown.

2 ea Cromemco 16FDC disk controllers. Both cards factory assembled, serial nos. unknown.

3 ea Cromemco ZPU central processor cards. 1 card assembled from kit, no serial no. Card dated on rear in black. 2 cards factory assembled, serial nos. unknown.

2 ea. Cromemco PRI printer interface

cards. Factory assembled, serial nos. unknown.

3 ea Cromemco 64KZ memory cards, 2 cards revision J1, serial nos. unknown. One of the two has a 10uf filter capacitor replaced with a blue tand, dip capacitor. 1 card revision G1 with IC76,77 replaced with ceramic IC's.

1 ea Cromemco DAZZLER color graphics card set. New, in box, serial nos. unknown.

3 ea Cromemco ZPU's, 1 card assembled from kit without serial number. Card has "KQ/XX" on reverse side where XX indicates date of assembly.

COMPUTERS

1 ea Cromemco System Z-2D. System new, in box. Serial number 22644. Manufactured approx. 4/81.

1 ea Test computer system. Custom test computer in light blue and gray bench top cabinet. System composed of Wangco 5 inch floppy disk drive. 12 slot Z-2H motherboard and custom power supply with cables for all Cromemco products. System contains various custom made circuit cards and modifications. With 64KZ memory card, 16FDC disk controller and ZPU.

FLOPPY DISK DRIVES

4 ea Persci floppy disk drives Model 299. Serial nos. #D4235, #D5270, #D6773, #D5070 Drives in for repair and not working at time of theft.

2 ea Qume floppy disk drives model DataTrack 8. Drives new, in box. Serial numbers unknown.

TERMINALS

2 ea ADDS model Viewpoint CRT terminals. Both units new, in box. Serial numbers 33060/33070 325760/325770.

TOOLS

2 ea Attache style tool cases, IBM cases. One case contained small hand tools of the Craftsman, Vaco, Xcellite and Crescent name brands. Also special tools for servicing IBM typewriters. There were spare parts contained in small black and clear plastic cases as well as in small clear plastic tubes with blue caps. The kit contained BK digital volt/ohm meter model 2800 with the ss# 536-54-5778 on the back in black. There were spare fuses in the battery holder. The other case contained handtools and spare parts as described above but with a Simpson Volt/ohm meter. One case can be identified by glue dripped on the outside below the handle.

MISCELLANEOUS

Many manuals from Cromemco hardware service and applications.

Approx. 60 5 inch floppy disks containing much software for use on Cromemco system two machines. Diskettes are mostly Dysan 104/2 with some Cromemco disks.

Many miscellaneous IC chips, various numbers such as 74XXX, 74LSXXX, 75XXX, Z80-PIO, Z80-CPC, etc.

Many printer ribbons for use in teletype and IBM equipment.



TEC TIPS is a regular column aimed at providing hints for keeping systems up and running. It will not attempt to deal with specific engineering applications or non-standard configurations. TEC TIPS is edited by Richard Quinn, owner of QUINTEC, a Southern California Computer service firm.

3102 HAS LOOSE ROMS

On occasions, Cromemco's 3102 terminal suffers from a loose memory ROM caused by jostling during shipment. Simply remove the keyboard connector from the terminal, remove the cabinet from the terminal and gently push the ROMs back into their sockets. Symptoms associated with this problem are a flickering screen without cursor or any other activity. Be certain that the power is off before pushing these IC's back into their sockets as there are several high voltage sources in and around the monitor.

3355A PRINTER HAS SELF-TEST

Cromemco's 3355A printer has a self-test mode that can be extremely useful when testing the printer. The switch is located on the printer interface card. To access it, simply open the top cover, remove the platen by depressing the small retaining button on either end, and remove the top cover by releasing the levers on the left and right inside covers. Following this, the test switch can be seen in approximately middle top of the interface card which is in slot number 2 of the electronics motherboard. The self-test switch is switch number four and should be moved to the "on" (up) position for self-test. Be certain to switch it while the power is off as there is a possibility of shorting out the printed circuit board in front of it. Following this, applying power to the printer should produce a test pattern similar to that which is shown in the 3355A manual. The printer should go smoothly through its entire character set including spacing. Check the printer for proper vertical and horizontal alignment of all letters.

Z-2H POWER PLUGS

In several Z-2H systems, I have experienced reliability problems with the computer which can be traced to the power supply connections. This is especially true of Z-2H multi-user systems where there are two or three users operating under CROMIX. The motherboard on the Z-2H system is a 12-slot assembly to the right of the hard disk drive. When facing the computer, the power plug connects to a 10-pin connector on the lower right-hand corner. The problem comes on the three ground pins of the motherboard. When the system is fully loaded with S-100 cards, these ground pins run extremely warm and have a tendency to corrode causing even worse connections. The problem is further aggravated by the fact that the fourth ground pin has been cut to provide a key so that the plug cannot be installed backwards. Inasmuch as the ground is common to the +8, +18, and -18 volt supplies, it has the greatest current load of any of the pins and therefore the greatest likelihood of failure.

The problem exhibits itself by symptoms usually associated with memory failure or the system simply dies. Some of our customers have experienced a situation where the computer would again operate if the S-100 cards were removed and re-installed. This procedure probably temporarily corrects the problem by moving the power plug and temporarily improving the connection. To determine whether or not your Z-2H is experiencing this problem, simply remove the power plug and examine it for discoloration. The white nylon plug, when overheated, turns to a dark brown or black. Also examine each of the pins that are soldered to the computer motherboard. If there are any burned or dark areas around the base

of the pins, then there is a very good chance this is your problem area. To correct the problem, simply unsolder the pins from the motherboard, cut the plug from the power cable coming from the power supply and strip, insert, and solder the wires in the original connector holes on the motherboard. Be certain that each wire goes to the correct hole. Crossing these power wires or placing them in the wrong hole could cause serious damage to the computer. It is advisable to check the power supply voltages on the motherboard after completing this modification to be certain that all voltages are correct and on the correct pins of the motherboard. There is an identical plug, unused, on the left-hand side of the motherboard that is a convenient location for voltage check. (Each voltage is silk-screened next to the appropriate pin.) Making a permanent solder connection of these powerlines removes this as a source of trouble and greatly reduces the resistance created by the defective plug. This problem does not occur with System 2's and 3's as both have these connections made via lugs and screws, thereby eliminating the troublesome powerplug. While I do not know for certain, I expect that there will be many failures of this plug in multi-user CROMIX or SDI Graphics Z-2H Systems.

(Editor's note: Cromemco became aware of this problem a few months ago. It discovered that there were no problems on single-user systems, but when systems were converted to multi-user under CROMIX the troubles started just as described. Since this discovery, Cromemco has been shipping these systems with the wires soldered directly to the motherboard, as recommended above.)

CROMIX WITH HARD DISK

In the last I/O News, I indicated that it was a good practice to allow the hard disk to warm up prior to any disk writes. This warm up was to allow the disk head time to expand and assume a stable operating configuration prior to any writing. Roger Knopf of Cromemco called with this additional suggestion: Do not do either reads or writes (in other words do not boot the system) when operating under CROMIX. The reason for this is that CROMIX logs in the date, time, and user during upon start up. As indicated in the last I/O News, writes to the hard disk, when it is cold, can cause data to be lost.

REVERSING FANS

Cromemco ships most computers now with the fans blowing into the cabinets rather than discharging from the cabinets. This is done by simply removing the four screws that hold the fan/grill assembly to the back of the computer and turning it around. Correctly positioning the fan will allow the electrical connection, which is made via a small rubber plug, to fit correctly. It may be necessary to snip a few of the white nylon wire ties in order to get enough length on the electrical connection. Cromemco says that having the fan blow into the unit as opposed to drawing out of the unit will lower operating temperatures several degrees at critical points. Also if you are in an environment which is subject to a great deal of dust or dirt, you can place an easily washed foam-type filter over the inlet of the fan. Be certain that this filter is cleaned regularly so airflow is not restricted.

USE ONLY THREE WIRES ON 4FDC

Even though the 4FDC has been out for many years, there still is an occasional problem associated with hooking up too many wires on the DB25 connector that attaches to J4 on the 4FDC. There are other control lines for dedicated functions that come out on the same connector and occasionally hooking other lines can cause problems. Symptoms associated with this are: system boots RDOS but goes into a wait state

Continued on page 29

Major New Enhancements to CROMIX

By Joe McCrate

When Cromemco introduced the CROMIX operating system over a year ago, it was immediately accepted as a major advance in the microcomputer industry. Never before had such a sophisticated operating system been implemented on a microcomputer. In fact to this day CROMIX is the only Unix-like operating system available on an 8-bit microcomputer. (For more information on the CROMIX operating system see Tom McCalmont's excellent article in I/O News, Vol. 1 No. 1.)

During the past year our software group at Cromemco has been responsible for designing and implementing a number of major enhancements to CROMIX. These enhancements will be incorporated in Version II of CROMIX which is scheduled for release this autumn. The four most significant of these new enhancements to CROMIX are:

- 1) Interprocess communication using "pipes" and "signals"
- 2) Execution of multiple processes in a single memory bank
- 3) Prioritized execution of processes
- 4) Record level lock

Each of these will be discussed in more detail below.

PIPES

A pipe is a conduit which can be used to direct the output of one command into the input of another command. A pipe is invoked with the vertical bar "|". For example,

```
type file1 | spool 1pt6
```

would cause the output of the TYPE command, namely the contents of FILE1, to be spooled to the device LPT6.

More precisely, a pipe directs the standard output of a process into the standard input of another process which is running concurrently. Standard input and output are I/O which normally go to the terminal of the user who executed the command. The data sent through the pipe is buffered in the operating system until the second process requests it. It is not buffered in a disk file.

To illustrate the difference between standard I/O and other I/O, consider the assembler program, ASMB. When a user issues the command

```
asmb file2
```

the shell calls ASMB and gives it the parameter FILE2. ASMB uses this parameter to get the name of the file to be assembled. It reads FILE2.Z80, assembles it, and produces two output files, FILE2.REL, which contains

relocatable code, and FILE2.PRN, which contains the print listing. However, ASMB also sends a message to the user's terminal when the assembly begins, another when it finishes, and error messages in between if appropriate. Sending these messages is the only standard I/O involved. ASMB does not read its standard input at all.

On the other hand, if the command

SORT

is issued, the SORT program will read the user's terminal until the end of the file is reached (simulated from the keyboard by entering the CNTRL-Z character), sort the data, and output the result to the terminal. In this case all I/O is standard I/O. Such programs are sometimes called filters. Pipes can be attached to a filter's input and its output in order to "filter" the output of one program before feeding it to the input of another. For example, the command

```
type file1 | sort | spool 1pt6
```

would sort the lines in FILE1 before spooling the result to the printer LPT6.

As we have seen, a user can custom-make a shell command line by connecting programs and filters with pipes. This is a very powerful facility. It should be noted that pipes can also be used by a program to communicate with subprograms which it has called. In other words, pipes can be used within programs as well as between programs.

SEQUENTIAL PIPES

CROMIX also provides sequential pipes to users of the shell. A sequential pipe, like a regular pipe, is used to direct the standard output of a process into the standard input of another process. But the data sent through a sequential pipe is buffered in a temporary disk file until the first process terminates. At that time the shell starts the second process and provides this temporary file as its standard input. A sequential pipe is invoked with the pair of symbols "><". An example of its use is

```
type file 1 >< spool 1pt6
```

The advantage of using a sequential pipe is that only one process need be running at a time because the processes run sequentially. The advantage of using a regular pipe is that the job gets done sooner because the processes run concurrently. Also, data sent through a regular pipe is buffered in the operating system rather

New Enhancements to CROMIX

than in a disk file.

SIGNALS

Occasionally a user may wish to send a signal to a running program in order to, say, abort the execution of the program. The ability to send signals like this is now implemented in CROMIX.

A signal can be thought of as a software interrupt. The usual effect of sending a signal to a process is to abort that process. However, a process can be set up so that it ignores a particular kind of signal or it can be set up so that every time the signal occurs a specified subroutine is executed. This latter alternative is referred to as "intercepting" the signal or "catching" it. A process catches a signal in order to have it perform some special function. These alternatives can be specified with the system call `.SIGNAL`.

If a process catches a signal, then all future occurrences of the signal will be ignored unless the signal's subroutine uses the `.SIGNAL` system call to specify that the signal be caught again the next time (or to abort). (This subroutine, by the way, is allowed to make system calls. It is not executed during an interrupt.)

If a signal causes a process to be aborted or if the process catches the signal (but not if the process ignores the signal), then all pending character I/O system calls are aborted. Character I/O involves devices such as terminals and printers, as opposed to disk devices. This feature makes it possible to get timed input from a terminal keyboard, for example. This can be done by setting the alarm to go off at the end of the time-out period (see below) and then executing the system call to read the keyboard.

There are several kinds of signals, as seen in the table.

TABLE

Signal Name	Signal Number	Function
SIGABORT	1	CNTRL-C signal
SIGUSER	2	user-specifiable-key signal
SIGKILL	3	kill signal (cannot be ignored or caught)
SIGTERM	4	terminate signal
SIGALARM	5	alarm signal (set by <code>.ALARM</code> system call)
SIGPIPE	6	broken pipe signal

SIGABORT and SIGUSER are signals which are normally sent whenever a user presses certain terminal keys. (CNTRL-C sends the SIGABORT signal. A key specified to send the SIGUSER signal.) A user can interrupt all of his or her own processes with either of these signals.

The privileged user can send the SIGKILL and SIGTERM signals to any specified process by means of the system call `.KILL` or by the shell command `KILL`. Other users can send them to one of their own processes. For example, the shell command

```
kill -4 123
```

would send the signal SIGTERM (signal number 4) to the process with identification number 123. This would interrupt that process unless it had been set up to ignore such signals.

A SIGKILL is the only kind of signal that cannot be

either ignored or caught. In particular, a process can be set up to ignore or to catch SIGTERM signals.

SIGALARM is the signal sent a process when its alarm clock goes off. The alarm clock is set by means of the system call `.ALARM`.

If a process attempts to write data to a broken pipe, that process will be sent the signal SIGPIPE. A pipe is broken if no process has the pipe open for reading, i.e., no process is at the other end of the pipe reading it.

MULTIPLE PROCESSES PER BANK

In the original version of CROMIX an entire 64K bank of memory was required for each user or task. So if two separate tasks were running, for example, each would require its own 64K memory card even if the sum of their actual memory requirements were less than 64K. Now two such tasks could execute in a single 64K bank of memory. This is accomplished by our new linker, called "BLINK", which produces a binary file for execution under CROMIX.

The following command will produce an executable binary file, `FILENAME.BIN`, from the modules, `MODULE1` and `MODULE2`, and the libraries, `LIB1` and `LIB2`:

```
blink module 1 module 2 -s lib1 lib2 -b filename
```

If the option, `-b`, were omitted BLINK would name the output file after the first module. In this example it would be `MODULE1.BIN`. The option, `-s`, specifies that the following library, `LIB1`, will be searched and only those parts of `LIB1` needed to resolve any undefined symbols in `MODULE1` and `MODULE2` will be included. Since this option was not specified before `LIB2`, the whole of `LIB2` will be included.

There is another option which makes a great difference in how CROMIX will handle the executable file produced. This is the option, `-r`. If this option is not specified then CROMIX will use a whole user bank to execute the program or file. However, if it is specified then BLINK will produce a binary file with a special format, known as a relocatable binary file. CROMIX will load this kind of binary file at the topmost free area of a user bank. It will use only as much memory in that bank as the file requires, leaving the memory below it free for other files to be loaded and executed.

The above example can be changed so that BLINK would produce a relocatable binary file, `FILENAME.BIN`:

```
blink -r -z 200 module1 module 2 -s lib1 lib2 -b filename
```

The option, `-z`, specifies the hex number of bytes to be reserved as working storage for the program beyond that specified when the program was assembled. If storage is reserved at assembly time (by means of that DEFS operation code) the binary file will be expanded by that amount to make room for it. This is not so if it is reserved at link time by means of the option, `-z`.

Many of the utilities supplied with CROMIX are now furnished in relocatable binary form, e.g., `ACCESS`, `CHOWNER`, `COMPARE`, `COPY`, `DUMP`, `ECHO`, `FIND`, `FREE`, `L`, `MAKDEV`, `MAKLINK`, `MATCH`, `MODE`, `MOUNT`, `MOVE`, `MSG`, `PRIOR`, `PRIV`, `ROOT`, `SPOOL`, `TEE`, `TIME`, `UNMOUNT`, `USAGE`, and `VERSION`.

The utility VERSION identifies a file as relocatable binary by displaying "RB" beside the version number.

PRIORITIZED PROCESSES

Multiple jobs running on a CROMIX system normally would be all treated with equal importance by the operating system, each getting its fair share in turn of the CPU time. But in some installations it is important that some jobs get more than their fair share of CPU time, so that they are executed more quickly, while other jobs can be allowed to have lower priority. This is particularly important in process control applications. In Version II of CROMIX, processes can now be prioritized.

Processes can be assigned priority numbers in the range -40 to 40. The lower the priority number, the higher the priority. Therefore -40 corresponds to the highest priority. The default priority number is 0. Only a privileged process can assign the higher priorities from -40 to -1.

The effective priority is the sum of the priority number plus a factor which is proportional to the amount of CPU time the process has recently been using. The lower this sum, the higher the effective priority. When it comes time to switch processes, CROMIX always chooses that process with the highest effective priority which is ready to run.

This scheme prevents one process from being overwhelmed by another with a slightly higher priority. It also favors interactive processes which don't use much CPU time.

A process can read its priority number by means of the system call .GETPRIOR and can set it with .SETPRIOR. It can also be set from the keyboard with the shell command PRIOR. Priority numbers are inherited by created processes from the processes which created them.

RECORD LEVEL LOCK

In some applications a data file or set of files is maintained which can be accessed by many users simultaneously. Difficulties can arise with this if the application is not designed properly. Consider the following possible sequence of events:

- (1) USER1 reads the record of employee 456654 of FILE1
- (2) USER2 reads the record of employee 456654 of FILE1
- (3) USER1 modifies the record and writes the result back to FILE1
- (4) USER2 modifies the record and writes the result back to FILE1

This would result in the changes being lost which USER1 made in step 3.

One solution is to lock the file before USER1 reads the record and keep it locked until the record is modified and written back. This has the disadvantage that nobody else can read any part of the file until USER1 finishes. USER1 might even decide to take a coffee break in the midst of this

A better solution would be to lock only the record to be changed. Other records of the file could then be accessed while USER1 was modifying that one. This is called "record level lock."

Continued on next page

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New Enhancements to CROMIX

CROMIX now provides a pair of system calls, .LOCK and .UNLOCK, which can be used for this purpose. The .LOCK call can be used to lock a sequence of 16 or less bytes, unless it already is locked. In the latter case, the system call provides an option of returning immediately with an error flag or sleeping until the sequence is unlocked. The .UNLOCK call, of course, is used to unlock a previously locked sequence.

When a lock is granted, CROMIX keeps a record of the contents of the sequence of 16 (or less) bytes locked. Until it is unlocked, anyone else who requests a lock on a sequence of bytes with the exact same contents will be denied. If the software which accesses a data base is written so that before updating a record, it always obtains a lock on a fixed, agreed-upon sequence which uniquely identifies the record, many users can update the data base at the same time without conflict.

What sequence of bytes should be locked depends upon the application. Assume the operating system is running one package of data base software, i.e., one package of software which uses the .LOCK and .UNLOCK calls, and, perhaps, some other software too. If the data base package is a set of files containing employee records of various sorts, then the employee social security number might be an appropriate sequence of bytes to lock when changing any employee record. Thus while one clerk is recording the fact that employee 499-33-2831 has been terminated, no one can update any other record

dealing with that (former) employee.

An important point to note is that CROMIX does not enforce these locks. Nothing in CROMIX prevents a piece of software from accessing a file record without checking whether it has been locked by someone else. All software which deals with the data bases should be written so that a record is always locked before it is read for updating, and only unlocked after the updating is completed. The application software must then check to see if a record is locked before allowing any other user to update it. If this is done, then the integrity of the data bases will be maintained.

SUMMARY

Version II of CROMIX has many new features which greatly enhance its usefulness. Signals and pipes can be used for communication between processes. Multiple processes can share a single bank of memory for more efficient memory utilization. Processes can be prioritized so that critical processes, say in a process control environment, can be serviced as quickly as possible. Record level lock now provides increased utility for Cromemco systems used in multi-user data base of business applications, remembering that the application software must be written to take advantage of the record lock feature.

In addition to the features we have discussed in great detail, many other enhancements have been made to the new version of CROMIX. CROMIX drivers are available now, for example, to support I/O not only using the TU-ART but also using the IOP and QUADART (see "The C-Bus, IOP, and QUADART" in I/O News Vol. 1 No. 2). The Cromemco SDI graphics system is now also supported under CROMIX. And there is even a new "CROGEN" program so that copies of CROMIX can be generated which include only the desired drivers.

The best way to fully appreciate all the new features of CROMIX is to ask for a demonstration from your local computer dealer. Subscribers to the CROMIX SUDS (Software Update Service) will automatically receive a copy of Version II as soon as it is released.

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Encode/Decode for BASIC

By Pat McGuire

Note: The following article assumes that the reader is familiar with Basic strings, Print Using, and the Str\$ function. It also assumes familiarity with file writes and reads. If you're rusty in these areas, I suggest you get out your Cromemco Basic manual and review the appropriate sections.

How often have you wished you could format the results of the Str\$ (X) function? Cromemco Basic provides a handy capability in this function. It allows creating a character string representation of a value that can then be used for print, display, or building other strings. For example:

```
600 Line$ = "TOTAL DUE: $ " + Str$ (Total)
```

If, at line 600, Total equaled 197.98, Line\$ would contain "TOTAL DUE: \$ 197.98". This would be a useful string. However, if Total equaled 1199.50, then Line\$ would contain "TOTAL DUE: \$ 1199.5". This is not so useful because it is not formatted properly. Here's where a "Str\$ Using" function would be valuable. Picture a Basic statement like the following:

```
700 Line$(11,20) = Str$(Total)Using "$##,###,##"
```

that would format the value of Total and place it into Line\$ just the way you wanted it, commas and all.

Another tricky situation is formatting dates into a string. Suppose that you have three variables, Month, Day, and Year, which have the values of a date, and would like to place these values into Line\$ (34,41), with slashes and leading spaces. If, for instance, Month=6, Day=4, and Year=81, you want Line\$ (34,41) to contain "6/4/81". You do not want "6/4/81", nor do you want imbedded null characters. In this case, your hypothetical function would look like this:

```
700 Line$(34,41) = Str$(Month,Day,Year)Using  
"##/##/##"
```

If you wanted leading zeros, you could use:

```
700 Line$(34,41) = Str$(Month,Day,Year)Using  
' &&/&&/&&'
```

Before you run off to your keyboard, let me remind you that you have no such function. Some FORTRAN implementations provide such a capability in a function called "ENCODE". The flip side of ENCODE is DECODE, in much the same way that "Val" is the inverse of Str\$.

Fortunately, you can accomplish the same thing in Cromemco Basic operating in CDOS, and do so at "electronic"

speed.

Remember that you can print to a file with the "Using" option. Assume that you are operating in 32K Structured Basic, and are not using file number (I/O channel) 7, nor any file named "ENCODE". Begin by creating a file named "ENCODE". If you create this file on your program diskette, then it will always be there and will not have to be created each time you run. This file will be very small, rounded up to 1K (2K for double density) by CDOS. I will make further remarks about other options concerning this file later.

Open the file as follows:

```
300 Open\7\ "ENCODE"
```

At this point, CDOS will cause a head seek to occur and establish a buffer for channel 7. Here is the significant point — ALL FURTHER ACCESS TO THIS FILE CAN BE MADE WITH NO ADDITIONAL HEAD MOVEMENT, until the file is closed. This is because all writes and reads to and from this file will occur in the first few bytes. Consequently, CDOS never needs to empty or refill the buffer, and all action occurs at full RAM speed.

You could solve the first problem as follows:

```
1000 Print\7,0\Using "$##,###,##",Total  
: Get\7,0\Line$(11,20)
```

The second example would be:

```
2000 Print\7,0\Using "##/##/##"Month,Day,Year  
: Get\7,0\Line$(34,41)
```

You must be careful to match bytes to the format, or you will get partial strings or excess characters (which could generate an error 138).

You could also accomplish the first example with a general purpose subroutine as follows:

```
100 Dim Line$(41),Format$(19),Buffer$(19)  
200 Long Value,Total  
300 Open\7\ "ENCODE"  
400 Line$ = "TOTAL DUE:      DATE DUE:      "  
:  
:  
:  
1000 Format$ = "$##,###,##" : Value = Total : Gosub  
    Encode  
1100 Line$(11,20) = Buffer$  
:  
:  
:
```


Encode/Decode for BASIC

```
5000 *Encode : Print\7,0\Using Format$,Value
      : Input\7,0\Buffer$ : Return
```

In this case, "Input" was used instead of "Get". This avoids subscripting Buffer\$, which would require another variable. This would not work for the second example, unless three Gosub's or a more complicated subroutine were used, since multiple values are involved.

When using 32K Structured Basic, a procedure could be used:

```
100 Dim Line$(41),Format$(19),Buffer$(19)
200 Long Total
300 Open\7,\"ENCODE"
400 Line$ = "TOTAL DUE:      DATE DUE:
```

```
1000 Format$ = "$##,###,##" : Call .Encode (Total)
      : Line$(11,20) = Buffer$
```

```
5000 Procedure .Encode (Value) : Print\7,0\Using
      Format$,Value
      : Input\7,0\Buffer$ : Endproc
```

There is another use for the "ENCODE" technique, involving binary file write and read operations. Assume a 128 byte record has been put to a file as follows:

```
1500 Put\F,N\A$(0,50),A,A$(59,100),I,A$(103,127)
```

In this example, "A" is typed long float and "I" is typed integer. Now consider what happens when a different program must read the file. There is no problem if you read the record as follows ("A" and "I" are as above):

```
2500 Get\L,K\X$(0,50),A,X$(59,100),I,X$(103,127)
```

Suppose, however, that you had read the record this way:

```
2500 Get\L,K\X$(0,127)
```

If you then determine (through examination of some other data, for example) that A and I are at bytes 51 and 101, you could go back and re-read the data:

```
3100 Get\L,K,51\A : Get\L,K,101\I
```

This may cause another access of the diskette (i.e., mechanical delay) if other accesses to channel L had been made since execution of line 2500. Your file "ENCODE" could serve you again:

```
3100 Put\7,0\X$(51,58),X$(101,102) : Get\7,0\A,I
```

Note that this is NOT equivalent to A = Val(X\$(51,58)) and I = Val(X\$(101,102)). Remember that X\$(51,58) and X\$(101,102) are the result of CHARACTER reads of BINARY writes. The following program illustrates the difference:

```
10 Long A,B,C : Dim A$(7),B$(7)
20 Open\7,\"TEMP"
30 Put\7,0,\"12345678" : Get\7,0\A$
40 A = Val(A$( - 1)) : B = 12345678.0
50 Put\7,0\B : Get\7,0\B$
60 B = Val(B$( - 1))
```

```
70 Get\7,0\C
80 Print"A = ",A: B = ".B: C = ".C: "
90 Print "A$ =>". For I = 0 To 7
100 Print Using "#####",Asc(A$(I)); : Next I : Print
110 Print "B$ =>". For I = 0 To 7
120 Print Using "#####",Asc(B$(I)); : Next I : Print
130 Close
```

```
>>RUN
```

```
A = 12345678. B = 0. C = 12345678.
```

```
A$ => 49 50 51 52 53 54 55 56
```

```
B$ => 72 18 52 86 120 0 0 0
```

```
***End***
```

```
>>
```

Statement 30 is an example of a character write and a character read. Statement 50 consists of a binary write and a character read. At statement 50, both A and B have the value 12345678. In statement 70, a binary read occurs. Since 50 was a binary write, C will also have the value 12345678. Statements 40 and 60, however, will have different results. This is because A\$ and B\$ are different, as illustrated by the printed results.

Thinking about this last technique suggests another — the "inverse" of line 3100 above. In line 1500, A, I, and 118 characters were put to a file. You could accomplish this as follows:

```
1500 Put\7,0\A,I : Get\7,0\A$(51,58),A$(101,102)
      : Put\F,N\A$(0,127)
```

It may appear that I've complicated things instead of simplifying them. However, there are times when you want to build a record completely in RAM, and then put it to a file, or vice versa. The above technique allows this. (This can also be accomplished with Basic-KSAM numeric sorting conversion functions if they are included in the Basic you are using.)

Some comments on the file named "ENCODE" may be useful at this point.

If you chain several programs together, you only need to open ENCODE once, and then leave it open as you run each program. Remember, however, that a "Close" statement without reference to a file number closes all files, as does a "Dsk"@"" command. Note also that, if no other use of that channel occurs, you do not need to ever close that file. This is because you do not need anything actually placed on disk. The file is opened only to provide access to the buffer and the I/O conversion routines. Still, good programming practice suggests closing all files to wrap things up when you're done.

Finally, it is really not required to open a separate file if one is available and won't be accessed for other purposes between the times you perform the first "ENCODE" and the last. Consider a status file that is opened and accessed at the start of a program, and then at the end, with no accesses in between. In this case, that file may be used instead of ENCODE. Remember to use only that portion that is never used for data. As an example, assume "STATUS" is opened as file 3 and record 1 is read. Assume further that record 1 is modified at the end of the program and the file is then closed, with no other references to file 3. If record zero is NOT used by this or ANY OTHER program, then record zero of file 3 may be used instead of

ENCODE. Similarly, you do not have to use record zero. A word of warning — be careful about file writes that leave large, unwritten gaps in a file. These gaps can cause error indications when using the STAT utility. Further, XFER is unable to transfer random access files of this type. To illustrate, the following WILL CAUSE PROBLEMS:

```
100 Dim A$(255),B$(20)
110 Create"BADFILE":Open\5,256\ "BADFILE"
120 A$="X"+A$(-1):For I=0 To 6
130 Put\5,I\A$(-1):Next I
140 Input Total
150 Print\5,200\Using"$##,###,###",Total
    :Input\5,200\B$
```

In lines 120 and 130 above, seven 256 byte records are written to a new file. This puts a total of 1792 (1.75k) bytes to the file. At line 150, record 200 (over 50k into the file) is written and read, leaving a large gap. CDOS has been told to access another 16k extent without accessing the second. This can cause directory problems. It is also one reason to write data files to their capacity with fill characters when they are created. Also be aware that getting a DiRectory in Basic may not give the correct size of an open file, if that file has been increased. Once the file is closed, DiRectory will give the correct size.

After getting familiar with this technique, you will probably think of other uses (data packing comes to mind).

You can write about 127 bytes without a mechanical access occurring, which allows quite a bit of manipulation.



About The Author

F.C. (Pat) McGuire Jr. is president of Advanced Computer Software, Inc., Garden Grove, Ca. He received a B.S. in Math from Marietta (Ohio) College and an M.S. in Systems Engineering from California State University at Fullerton. He was introduced to programming in 1959 on an IBM main frame — the size of a room but not as powerful as a System Zero. He has since programmed in Fortran, PL/1, Assembly and Basic on main frames, military and commercial minis and micros, as well as real time tester languages. He designed and implemented the data base for the MX advanced electronic parts data. He authored a textbook on statistical quality control and developed a new inverse tolerance technique for statistical acceptance of high reliability electronic devices based on radiation samples.

Pat has developed an advanced payroll system that is fully compatible with the Cromemco Business System software. His firm specializes in payroll, production control, and custom software.

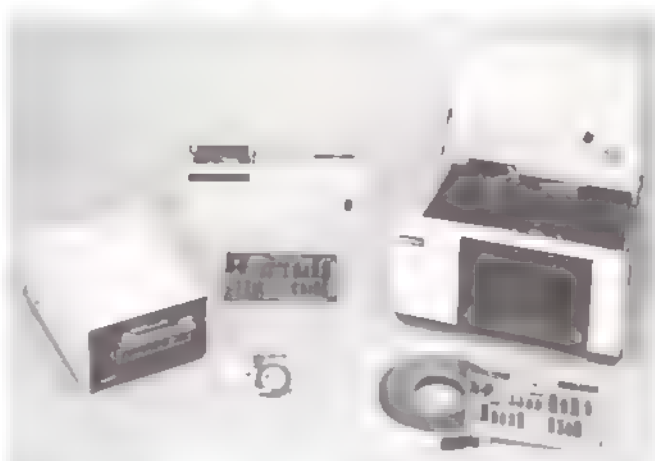
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the COBOL corner

By Jim Alewel
President of Automated Programming Methods, Inc.

This column to be a regular feature of I/O News if reader interest warrants. It's designed to be an avenue of information exchange pertaining to Cromemco COBOL and its interfaces with DOS and CROM-X.

This first article covers one "HOW TO" idea you may find helpful. Future articles will delve into specific problems encountered and solutions discovered to eliminate them. If you have a few goodies you would like to share, let us hear from you and we'll pass them along as space permits.

Ever try to do something special with your CRT? Turn off the cursor? Erase to the end-of-line (not the rest of the screen)? Ever need to create a print image on disk to be printed later and want to control page overflow without having to write a special print program? How do you do it in COBOL? The answer is simple, but takes two steps, namely what do you do and how do you do it?

1. You need only DISPLAY some special one byte characters such as "escape" followed by the letter "Z" to clear the screen to the end-of-line. These "function codes" are tabled in your 3102 VIDEO TERMINAL user's manual for those of you that have CROMEMCO 3102's. To cause a skip to a new page to be written to a disk record, you need only include in the disk record a formfeed character. The catch is how to define those special codes like "escape", "erase-to-end-of-line" and "formfeed" which brings us to the second step.

2. Define in the WORKING-STORAGE SECTION, a computational item which we choose to call BINARY-ITEM. Redefine BINARY-ITEM with a group item. Define two single character alphanumeric elementary items subordinate to the group item as shown below (since computational items always contain two bytes (16 bits).) We only need the last item for this routine and we'll name it "LOW-ORDER-BYTE".

In the PROCEDURE DIVISION, it is necessary to move a decimal number (equivalent to the ASCII character needed) to BINARY-ITEM. The LOW-ORDER-BYTE may then be moved to any other dataname for subsequent use in DISPLAY statements to the CRT or WRITE statements to disk. Note the characters "escape" is a decimal 27, the

"erase to end-of-line" is a decimal 75 and "formfeed" is a decimal 12. When formfeed is included in the body of a record written to disk and later printed (typed using CNTRL - P), it causes the record containing the formfeed to be written after a page eject. The formfeed character (CNTRL - L) occupies one byte on disk but is interpreted as a control character by the printer and therefore does not print.

Here is the coding for those who speak COBOL!

WORKING-STORAGE SECTION.

```
01 MISCELLANEOUS-DATA-AREA.  
  05 BINARY-ITEM                                COMP PIC S9(2)  
  05 FILLER REDEFINES BINARY-ITEM.  
    10 FILLER                                    PIC X(01).  
    10 LOW-ORDER-BYTE                           PIC X(01).  
  05 ESCAPE-CHAR                                PIC X(01).  
  05 ERASE-TO-EOL                              PIC X(01).  
  05 FORMFEED-CHAR                             PIC X(01).
```

PROCEDURE DIVISION.

INITIALIZATION SECTION.

GENERATE-SYMBOLS.

```
MOVE +12 TO BINARY-ITEM.  
MOVE LOW-ORDER-BYTE TO FORMFEED-CHAR  
MOVE +27 TO BINARY-ITEM  
MOVE LOW-ORDER-BYTE TO ESCAPE-CHAR.  
MOVE +75 TO BINARY-ITEM.  
MOVE LOW-ORDER-BYTE TO ERASE-TO-EOL.
```

MAIN-PROCESS SECTION.

TOGGLE-CURSOR-ROUTINE.

```
DISPLAY (LIN, COL) ESCAPE-CHAR, "Z", "TEXT IF  
REQUIRED..."
```

• ***** ABOVE LINE WILL TURN OFF CURSOR IF ON OR
IF OFF *****

ERASE-TO-END-OF-LINE ROUTINE

```
DISPLAY (LIN, COL) ESCAPE-CHAR, ERASE-TO-EOL.
```

• ***** ABOVE LINE WILL ERASE LIN FROM COL TO THE
END OF LINE *****

Send your COBOL question, or comments to

THE COBOL CORNER • c/o I/O News



Cromemco recently announced the availability of a new, low-cost parallel printer for use with Cromemco systems. The microprocessor controlled impact parallel printer (Model 3715) prints 9 x 7 dot matrix characters at a rate of 150 characters per second. The printer can print both upper-case and lower case characters. The 3715 printer can also print character sets for both English and French.

Using host generated control codes, character densities of either 10 characters per inch or 16.36 characters per inch are available. Up to 80 characters per line can be printed at 10 characters per inch and up to 132 characters per line can be printed at 16.36 characters per inch in line lengths up to 8 inches. Both

New, Low-Cost Parallel Printer Available For Use With Cromemco Systems

the 10 and 16.36 character densities can be elongated in a line by host generated codes. Elongated characters are printed double-width.

The 3715 has a three-way paper handling system which accepts 9½-inch wide standard computer fanfold forms, 8½-inch wide roll paper, and 8½-inch wide single sheets.

The printer is completely self-contained and composed of mechanical, electro-mechanical components and a logic printed circuit board. The logic board uses microprocessor technology to minimize components and increase reliability.

The Model 3715 parallel printer is available from Cromemco dealers for \$1295.

ATTENTION

WordStar Users

or

Potential WordStar Users

We would like to bring to your attention our special customization program, allowing you to customize WordStar which will take advantage of 36 function keys, plus the 4 cursor control keys on the Cromemco 3102 CRT Terminal

WordStar is a very comprehensive word processing software package. Combined with the ease of use and elimination of the required control command codes, the customized version of WordStar is made even more powerful.

The appropriate modifications which we developed for WordStar are automatically applied by running our customization program. Our special customization program uses as input the WordStar program module and makes the appropriate mods quickly and easily.

Special Cromix versions are also available. WordStar constantly polls the console for input. This is done via a looping technique which literally ties up the CPU. This method of detecting console input is fine for a single user system, but not for a system offering the multi tasking/user capability of Cromix. Our customization program modifies WordStar so that console input is detected on an interrupt basis thus allowing better CPU utilization by other tasks/users. There are various control command codes that are directly intercepted by Cromix and never seen by WordStar. Our customization program enables WordStar to issue actual Cromix system calls for console input. The result allows those special control command codes to be delivered to WordStar.

The above two very important features are implemented in both the Cromix/3102 Customization package and the Cromix/non 3102 version package.

WHAT YOU GET

- One single sided, single density 8 inch or 5 1/4 inch diskette containing the customization program
- An instruction manual, giving you a step by step walk thru on how to produce your customized version of WordStar
- One user's manual describing in easy to understand language, how to use your new customized version of WordStar
- One template to put over the top part of the 3102 keyboard, which will show the new values of all the function keys
- An additional customization program allowing you to modify WordStar so you can use your Cromemco 3355A printer utilizing all of its capabilities

FEATURES INCORPORATED INTO FUNCTION KEYS

Abandon Edit	Functional Cursor Keys	Repeat Next Command
Bold Face (Start/End)	Help Menu	
Center Text	Insert File at Cursor	Save Edit & Return
Delete Character	Jump to Beginning of Doc	Scroll Screen Up
Delete Character Left	Jump to End of Document	Start Block Marker (set)
Delete Line	Line Spacing (set)	Strike Out (Start/End)
Edit control Command Menu	Move Block	Superscript (Start/End)
End Block Marker (set)	Printer Page Eject	TAB Key
End of Line Clear (EOL)	Print a Document	Underline (Start/End)
Find & Replace	Reformat Paragraph	Write Block Out
Find & Replace Again		

WHAT IT COSTS

Customization Program Package (includes all items described above) to produce:

- | | |
|--|-------|
| • WordStar running under CDOS/3102 Customization | \$195 |
| • WordStar running under Cromix/3102 Customization | 295 |
| • WordStar running under Cromix/non 3102 version | 295 |

Combination Packages

- | | |
|---|-----|
| • Purchase of WordStar with CDOS/3102 Customization | 595 |
| • Purchase of WordStar with Cromix/3102 Customization | 695 |
| • Purchase of WordStar with Cromix/non 3102 version | 695 |

The above three combination packages do not include the Mailmerge option which is \$150 additional.

WHERE YOU CAN GET IT

Call or write
Dealer inquiries invited



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Customization Template

Products Continued from first page

English language. Cromemco's new Fontmaster package allows a user to design character sets for his own needs, and can even be used to generate Arabic, Japanese, or Chinese characters.

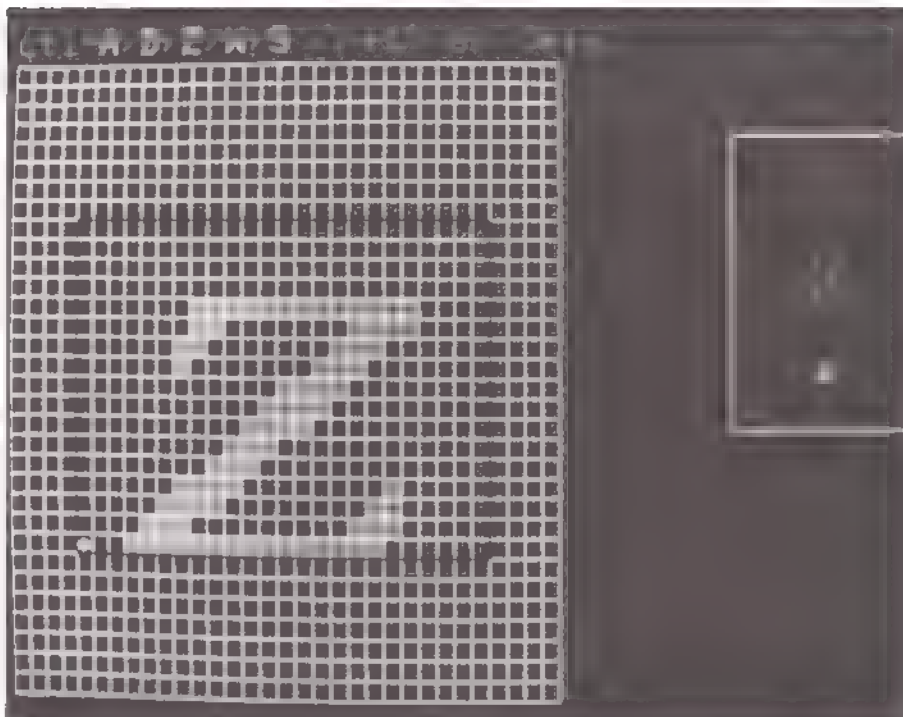
With Fontmaster a grid is displayed on the RGB monitor of a SDI system; each character of the character set is defined within this grid, as shown in Figure 1. By defining each character in this way a wide variety of character sets can be generated, as shown in Figure 2. In addition to allowing a user to generate his own character sets, Fontmaster comes with ten standard type fonts that have already been generated including rondo, radiant, bembo italic, and cheltenham.

Another new graphics software package from Cromemco is called the Tri-SDI Graphics System. Normally a single SDI interface in a Cromemco computer is used to drive the red, green, and blue guns of an RGB monitor. With this arrangement 16 colors can be displayed simultaneously in medium resolution mode (241 x 378) and 2 colors in high resolution mode (482 x 756). The Tri-SDI software is a version of Cromemco's SDI graphics package which has been expanded to support three SDI interfaces. With this arrangement it is possible to display 4096 colors simultaneously in medium resolution mode, and 8 colors simultaneously in high resolution mode. The Tri-SDI package also includes the cables required to interconnect three SDI interfaces.

Cromemco has also come up with a low-cost way to get hard-copy images from your SDI graphics system. It's their new camera adapter for the Cromemco RGB-13 monitor. The adapter hooks securely to the case of the RGB-13 monitor and has an adjustable camera mount to accommodate virtually any camera (see Figure 3).

A Polaroid SX-70, for example, can be used for immediate hard copy, while color slides can be taken using a 35mm camera.

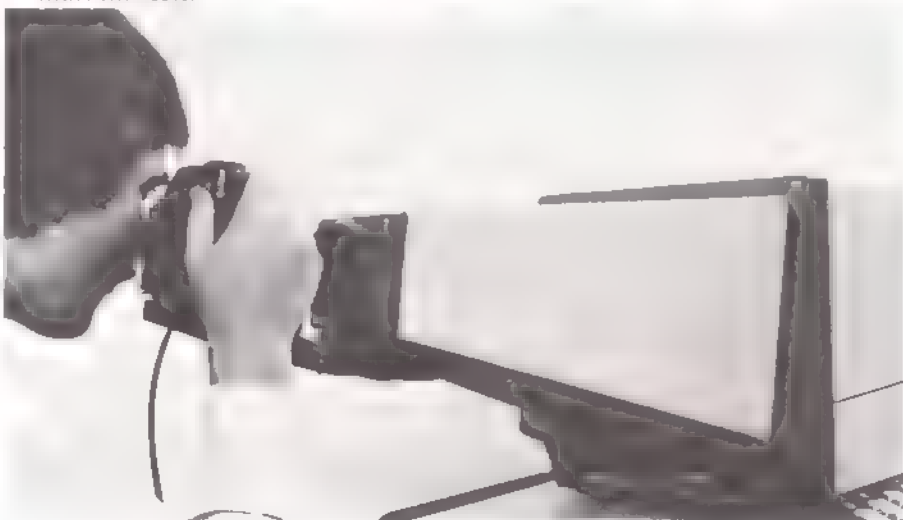
As seen from these new products, Cromemco is obviously putting continuing R&D effort into its high-resolution color graphics line, and it will be interesting to see what other new products are announced in the months ahead.



1. Using Fontmaster, squares of a grid are filled in to create each character of a character set



2. A photo from an RGB monitor screen showing some type fonts and characters generated with Fontmaster



3. The new RGB camera adapter provides an easy way to take photographs of the RGB monitor

software treasure chest

We are in the process of finalizing negotiations and details on making the P.D. software announced last issue available to members. It looks as though there are some 50-75 disks that will eventually be distributed, with an average of 18-20 programs or utilities per disk. A partial keyword sampling from three of the diskettes follows. We will be able to send a complete listing (some 30 pages) of a keyword index of all available disks for \$6.00 to any member who requests it. You may have it charged to your VISA or MasterCard by using the form below.

ACCOUNTING Ledger Type Program	CONCATENATE Concatenate Assembler Source Files & Remove Contents	EXPENSES Ledger Type Program
ADDRESS LABELS Print Return Address Labels	CONCATENATING RATFOR Preprocessor	FAST I/O Faster Utility Execution
ADVENTURE Adventure A02 Version	COPY A Faster Track Copy Program A Track Copy Program Copy Program	FILE COMPARISON Split Screen Video File Comparison Utility
AMATEUR Moon Location Programs Morse Code Practice Program Morse Code Receive Program Morse Code Transceive Program Radio Teletype Transceive Program Random Text Generation Program Teach Morse Code Program	CROSS REFERENCE Cross Reference Generator of Assembler Code	FILE COPY A Faster Track Copy Program A Track Copy Program Double Density Format & Copy Utility
ASSEMBLER SUBROUTINE Multiple File Reads with Wildcard Names	CURVE FITTING FORTRAN Subroutines	FILE READS Multiple File Reads with Wildcard Names
ASTRONOMICAL CALCULATIONS Astronomical Calculations Moon Location Programs	CYPHER Encode and Decode of Files	FORTRAN Adventure A02 Version FORTRAN Subroutines RATFOR Preprocessor
BASIC Change Keywords in BASIC Interpreter	DIABLO HYTYPE I DRIVER Software Driver for Diablo Printer	FORTRAN BYTE HANDLING Astronomical Calculations
BIT MAP Bit Map for Various Formats, Densities Print Bit Map	DECODE Encode and Decode of Files	FREE SPACE Print Bit Map
BYTE RATFOR Preprocessor	DELETE FILES Interactive Disk Cleanup Utility	FUNCTION PLOTTING FORTRAN Subroutines
BYTE HANDLING Astronomical Calculations	DIRECT BIOS CALL Diskette Directory Three Across Diskette Sector Handler	FUNCTIONS RATFOR Preprocessor
CDOS CDOS Comments Filter for CDOS Programs on CP/M	DISASSEMBLER Disassembler Using TDL Mnemonics Interactive Disassembler	GAMES A Friendly Game of Computer Chess Adventure A02 Version Game CRAPS - BAS Simulates Electronic TV Game PONC
CATALOGING Diskette File Name Cataloging System	DISK CONTROLLER 486 Bios and Boot for CP/M CBIOS for 8221 Disk Controller	HARDWARE CDOS Comments
CHAINING Math Problem Generator System	DISKETTE Diskette File Name Cataloging System	HEX FILE COM file to HEX Format File Converter
COMMENTS CDOS Comments	DOUBLE DENSITY Double Density Format and Copy Utility	I/O Faster Utility Execution
COMMUNICATION Memory Buffering to Diablo Hytype Modem Communications System Modem Programs	EPROM Program EPROMS with Connects of COM Files	INCOME Ledger Type Program
COMPUTIME COMPUTIME Real Time Clock Calendar	EDITOR Text Editor	INDEX RATFOR Preprocessor etc., etc., etc
	ENCODE Encode and Decode of Files	

As noted, the above list is only a sample of how the keyword index is printed. A brief reading shows that there is quite a bit of cross referencing of specific programs or utilities under different subject headings. To receive a complete index, copy the form below and mail to: IACU, P.O. Box 17658, Irvine, CA 92713.

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 Signature _____

bits & bytes, nibbles & tweaks...

CP/M SCREEN EDITOR FOUND

Last issue Bill Purpura noted that his company was in desperate need of a screen editor that will operate under Intelligent Terminals Corporation's CP/M. We received this letter from Roy Christmann of ITC:

"We use Micro Pro's WordMaster for all our program development here. It's a little harder to learn, but far more powerful than screen.... the Cromemco 3102 can be used..."

Thanks, Roy. We passed the info on to Bill, but we thought we'd go ahead and print this in the hopes it will help others in a similar situation.

A TIP FROM CROMEMCO

The older, 277 drive motors turned off under software control when idle. This saves wear and tear on both drives and diskettes. Unfortunately, the newer, 299 double-sided drives use an AC motor which prevents automatic turn off. The motor continues to run at all times that the computer is on. This can be particularly wearing on heads and diskettes — especially diskettes. So, if your system is equipped with the 299 drives, remember to eject the diskette and physically remove it from the port whenever it is not essential to operating.

DETROIT AREA USERS INVITE GUESTS

The Detroit Area Cromemco Users' Group is now up to 20 active members, and still growing. Anyone interested in becoming involved with this very active group can call Ford Buckner at (313) 420-2183. Ford also extends an open invitation to anyone visiting Greater Detroit to drop in for a visit. It could be illuminating.

NEW PRODUCTS ON TARGET

In the March/April issue we announced several new products coming from Cromemco. It appears that the deadlines are all on target. WriteMaster has already been released, and the System One has had a prototype production run. Ten systems were produced for testing and modification. After testing, Cromemco reports no modifications are necessary and they will begin taking orders for end-of-year shipments. The price is \$3995. We will run a full set of specs soon.

CROMEMCO IMPRESSED WITH SUPERCOPY II

Cromemcohorts, the West Los Angeles Users' Group has, in a very short time become well organized and a model for other groups. We thought we'd share this letter from Bill Cannon, President of the group, not only for its message, but also for the inherent message of the organization of the group:

Although the Cromemcohorts Users Group of the Greater Los Angeles Area has not set itself up as a testing facility or proving ground, I thought you might like to know something of our collective opinions concerning U.S. Dynamics' SUPERCOPY II.

The Group has a firm policy that allows us to demonstrate and try commercially produced software that has been purchased by a fellow-member, but if a member wishes to utilize the program for his own use, he must purchase the software from the authorized supplier. We feel that this policy is fair for all, for it affords remuneration to the programming source, and it gives us users a chance to assess program effectiveness before purchasing an unknown and untried program.

To this end I recently responded to your front cover ad and telephoned U.S. Dynamics for a copy of SUPERCOPY II. I, like so many of my colleagues, was weary of waiting on the back side of XFER/V*.* when generating backup disks.

I was so astonished when I first ran the newly arrived program—I copied a full 8" DS DD disk in a tad over 60 seconds—that I immediately asked a number of Cohorts to see SUPERCOPY II, and recommended its being included in the private libraries of our members.

The most often mentioned rewarding points were ease of installation, speed of copying, accuracy, and the comfort of having verification of the results.

It is gratifying, indeed, to reach out through I/O News and be so pleasantly rewarded.

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The program can handle structures with up to 127 joints and 250 members (most of the everyday engineering problems will certainly fit into these limits). For example, a six story, three bay frame, with three load cases takes about six minutes of execution time. The program also includes sophisticated data generation facilities. Works under CDS or CROMIX.

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Computers in Architecture Continued from first page

of repetitive, typed material—specifications, change orders, proposals, contracts, etc. Recently, the maturing of word processing and other software on the microcomputer has made it feasible for the small office to automate. The rush to automation appears to be on! Architectural professional journals and professional society meetings are abuzz with information about computers and word processors.

Computer assisted design and drafting on inexpensive (under \$30,000) systems is just now becoming a reality. The hardware and software in this area need about another year to mature. Within 2 or 3 years, it appears to this author that no architectural firm will be able to remain competitive without extensive automation.

In the past two years, I have installed 17 turnkey microcomputer systems for architectural firms ranging in size from 2 to 32 people. This article will attempt to make communication between the architect and the computer/word processor vendor somewhat easier. It will cover specific tasks which the computer/word processor can do for the architect. If you are an architect, some of the explanations may seem elementary. Believe me, they will not seem so to the computer vendor who doesn't speak "architect". If this article serves its purpose, the architect should be able to tear it out, hand it to his would-be computer vendor and say "There—that's what I want. When can you deliver it?"

WORD PROCESSING

Automatic typewriting has been around for at least 30 years. The computer has increased the power of this technology by several orders of magnitude in the last three years. First, a document is typed onto a video screen, where errors can be corrected easily before they get on paper. Then, the text is stored on a disk which can hold up to several hundred pages. Any portion of the text can then be recalled for printing, further editing or combining with other text. The disk is a permanent storage medium and can be easily shipped around the country.

Some specific applications to architects are:

Specifications: Every architect firm which designs a building is faced with the task of putting together 250-500 typed pages of "specs" on the building. The specs lay out in detail the materials, strength tolerances, wearability standards and procedures for installation, among other things. A typical spec might contain four pages of details on the "automatic door equipment" in the building.

Productivity jumps dramatically when the architect starts using word processing for specs. Once the specs are keyboarded onto a disk, they need never be typed again. Architects tend to specialize in a few types of buildings. Many of the changes in the spec used for a previous building are minor. The file can be called from the disk, edited and printed with a few minutes work. Equally important, the major portions which were not touched do not have to be proof-read. The computer does not make typing mistakes. This saves enormous amounts of time for the spec writer and the project architect, as well as the typist.

Master specifications put out by national firms are used by most architects. They provide a certain amount of legal protection. They have been researched by a battery of attorneys and construction experts. They are updated quarterly as new materials or techniques are developed or to incorporate new legal decisions.

Two agencies publish the most popular versions of master specs:

1) MASTERSPEC2 is published by Productions Systems for Architects and Engineers, Inc. (PSAE), 1735 New York Ave. N.W., Washington, D.C. 20006. Telephone (202) 626-7369. Dealers throughout the country sell MASTERSPEC2 text files on computer disks in various formats. A list of dealers and the type of disk format they handle is available by calling or writing PSAE.

2) SPECTEXT is published by The Construction Specifications Institute (CSI), 1150 Seventeenth St. N.W., Suite 300, Washington, D.C.

20036. Telephone (202) 833-2159. These masters are likewise available from a number of dealers on computer disks. Contact CSI for further information.

CAUTION: Any architect using a master spec from a disk supplied by a dealer **must** have subscribed to and have on hand the current hard copy version of the same master spec. The hard copy version is available only from PSAE or CSI. This is an important legal requirement.

Keynotes: Virtually all drawings and tracings of building details prepared by draftsmen in architectural offices contain hand-lettered explanatory notes. These are included in the body of the drawing or "keyed" with numbers or symbols to a sidebar. Changes to these notes are frequent during the design and redesign of the building. Making these changes by redoing the hand-lettering must be one of the most tedious and boring tasks in the world. One of the quickest improvements in productivity comes when the architect and his draftsmen begin using the word processor to produce and edit these "keynotes". This can be done by having the computer print them on either Mylar or "sticky-back" paper. One architect estimated that this change alone saved 40% of his draftsmen's time.

Job Cost Accounting

Accurate data on the cost of each design project is vital to the survival of any architect firm. This accounting involves capturing expenses for labor by the in-house design and drafting team, usually called direct labor. It also requires data on expenses for overhead for supervision, clerical support, accounting and so forth, usually called indirect labor. Even time off the job for vacations, illness, holidays and "other" must be recorded. Other expenses for contract labor (engineers, interior designers, etc.), materials, travel, long distance telephone, etc. must be captured and assigned to each job. Some of these latter expenses are "direct"—i.e. chargeable to the job expense, and some of them are "reimbursable"—i.e. billed separately to the client.

When cost data by job is available, it can be used for a variety of purposes:

Profitability of each job can be determined at any time. If the job is a "loser", the portion of the work causing the problem can be pinpointed.

Future similar jobs can be estimated and bid more accurately.

The productivity of employees can be measured and compared.

The overall profitability of the firm can be determined. Without such a system, this is very difficult because of the large amount of work "in progress" which has not been billed to the client at the end of any normal accounting period.

With such obvious benefits, why do so many architectural firms have such difficulty with this function? Two reasons: 1) it is very difficult to gather and "massage" all the data required; and 2) all human beings would rather take castor oil than fill out a time sheet!

A computer system will not solve the second problem. Only good management can do that. However, a good computer system has proven invaluable to many firms for getting on top of the mass of data involved. Software is available now which does a very professional job in this area. Some of these packages are designed by architects specifically to fit their practice. These are probably the best. More elaborate software packages, designed and programmed by professional architects, which integrate all of the general accounting (general, ledger, payables, payroll, receivables) with the job costing are just now coming on the market. All of this software runs on small, inexpensive microcomputers. As with any other computer software, the safest approach is to check with one or more current users and, if possible, see it operate before you commit to buy it.

Construction Cost Estimating

Most architectural firms are required to prepare a "Preliminary Cost Estimate" for their client. This usually requires anywhere from 1-2 days to two weeks of a project archi-

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Computers in Architecture

tect's time. Cost figures on comparable buildings have to be dug out of estimating manuals and adjustments made for any unusual features. Building codes have to be researched to determine how many site parking spaces are required, how large the site must be, elevators required, etc. This is one portion of the architect's job which has been effectively automated in recent months. At least one software package is available for an in-house microcomputer which provides a quick and accurate preliminary estimate with only a few minutes work by the architect. Equally important, multiple options of the building configuration can be "run" and their costs compared in a few minutes. This package has been used on hundreds of commercial building projects all over the country. Designed by a professional architect, this package produces a remarkably accurate estimate. Accuracy is usually within 5% of actual sub-contractor bids. These estimates can also be obtained on a "service center" basis.

Detailed "Take-off" Estimates

A separate, more detailed estimate of construction costs is done when the plans and specifications for the building are complete. This is called a "take-off" estimate, since the numbers concerning the requirements for gypsum board, concrete, doors, windows, etc. are "taken off" the plans and specifications. There are useful software aids for this function available now and more coming. These are general purpose software packages which help organize and manipulate the rows and columns of data on the video screen instead of on paper. The logic of the estimate can be placed on the screen first. The estimator is prompted as he does the estimate so that nothing is overlooked. Formulas for calculations can be made a permanent part of the file and easily changed. These software packages are provided free with some microcomputers and can be purchased inexpensively for others.

Income Property Analysis

"Income property" includes apartments, hotels/motels, office

building, shopping malls and combinations of these. Early in the conceptual life of each project, someone must do a study to determine the financial feasibility of the project. Will it pay for itself? If so, how much profit will it generate? How soon? If not, what can be changed to make it profitable and what is the impact of these changes? The architectural firm which can perform this type of feasibility study for a client is in a strong competitive position. They are much more likely to get selected to do the design work on the project. Several architect firms I am familiar with use this capability as a strong part of their marketing program. Combined with the construction cost estimating software package on their in-house computer system, this Income Property Analysis package gets them all the business they can handle. In the six months starting September, 1980, one firm grew from 17 to 31 people, primarily on the business generated by these two software packages.

Using the Income Property Analysis package the Project Architect can vary the assumptions about construction cost, financing, income, operating expenses, fill-up period, etc. and see the impact in a few minutes. The initial operating deficit (caused by expenses which exceed the initial cash flow) is calculated automatically. Because of the large number of variables involved, it is not feasible to perform this analysis on a service center basis. It is an ideal application for an in-house computer system.

Area Calculations

Simple programs are available which calculate quickly the area of an unusually shaped room or piece of property. Other programs calculate the cost of the common areas of a rental building and spread this cost pro rata among the tenants.

Compensation Management

One architect has developed a program which continuously analyzes his employees' compensation. The program assumes that each employee should at least be looked at for a pay raise each six months. It keeps track of those due to be look-

ed at. It allows you to assign the employee a performance grade and then suggests a pay raise based on his/her history of raises, performance, and relationship to other employees doing similar work.

Framing Calculator

This program gives the architect or contractor a quick idea of the material and labor required for general wood frame construction. You may also use it to evaluate alternate framing methods, such as 2x4 on 16" centers versus 2x6 on 24" centers.

Critical Path Method

This package produces a very thorough and professional looking version of the Critical Path Method chart. It can easily be modified or updated and the chart rerun in a matter of minutes. Relationships between phases of the job are shown as well as slack time and the critical path.

A Computer Shopper's Checklist

You can profit from the experience of your fellow professionals. Here are a few guidelines. Following them will virtually insure success for the first-time computer buyer:

1. Find the software first. Then look for hardware which will run it.

2. If possible, see the software work on the hardware you're considering buying. Next best, if this is not practical:

- a. Talk to someone in your profession who is using this exact hardware/software combination.
- b. Purchase the hardware and software from the same vendor. You can then hold his feet to the fire if it doesn't work as advertised.

3. Buy a general purpose computer which can do word processing, not a dedicated word processor.

4. Seek the help of a consultant. You are about to make a large financial commitment and a major commitment of your time as well as your office staff's. Some professional help up front can make the computer begin paying for itself immediately.



About the Author

BILL HENDERSON is founder and President of Micro Mode Inc. of San Antonio, a computer systems house which specializes in turnkey systems for architectural offices. He has personally installed 17 such systems throughout Texas and in other parts of the country. He has consulted with numerous other architectural firms on their selection of hardware and software. Bill retired as a Colonel from the U.S. Air Force in 1977. He has a Masters of Business Administration degree from George Washington University. He may be contacted at:

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Key Personnel: William Hutchison, President
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Major Market Area:

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Major Market Area: United Kingdom, Europe

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Sales — Worldwide

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Major Market Area: Sales & Service: London, extending throughout United Kingdom.

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New Tool For COBOL Users

The COBOL Programmer's Aide, an extensive set of programs developed to aid the experienced COBOL programmer is available for September delivery, stated Joseph P. Flaherty, Jr., Chief Executive Officer of Automated Programming Methods, Inc.

The main purpose of the COBOL Programmers Aide (CPA) is to provide an easy method to add the "professional" finishing touches to programs written in the COBOL language. Originally designed for use by systems houses and OEM's developing COBOL systems for clients, it is now available to all Cromemco COBOL users. The complete package provides the user with the ability to accomplish many functions, some never before available even to large mainframe users.

Functions available include: complete reformatting of source pro-

grams with a built in word (not character string) substitution capability (many words may be substituted in one pass); resequencing of source programs with or without included "copy" statements; a source program analyzer (very good for debugging and documentation) that provides an alphabetical cross reference of each data-name, literal and verb used in the source program, shows where it was defined, how it was used, and at which source line it was changed, performed, or altered; and an overview defining the structure and content of the program (a real help for those who write structured code).

A very nice feature included is the ability to tailor the package to the user's own specifications. Installation standards may be preset to defaults. Such defaults as paper size, lines per page, outputs to printer,

disk or both, work drive assignments, etc. may be preset by executing a user oriented tailoring program supplied with the package. The COBOL reserved words used by some of the programs are external to the programs and may also be updated when needed thus eliminating obsolescence.

The system operates in either a CDOS or CROMIX environment and may be run concurrently by multiple users under CROMIX.

The COBOL Programmer's Aide is available on 5¼" or 8" diskettes from: Automated Programming Methods, Inc.
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tec-tips

Continued from page 8

when booting CDOS. This is especially true where the connecting cable from the CRT to the computer is constructed of a ribbon type cable. Be certain that only pins 2, 3 and 7 are used when using RS232 type interface or pins 17, 23, 24, and 25 when using 20-milliamp current loops.

Z-4D?

We have created a number of Z-4D and Z-3D computers. While this is not an actual model number, what we have done is to cut the front panel of the Cromemco Z-2D to add a third or fourth disk drive. The mounting cans with voltage regulators is easily fitted to the left of the existing two drives. Putting together a ribbon cable that accommodates the third and/or fourth drive, along with an extension of the existing power cable, easily creates a three or four drive system. The disk controller requires no modifications as it is designed to handle up to four drives ½ ½ - 0 problem. Adding the extra drive gives considerably more disk storage space at a cost well below that of adding an 8-inch drive or hard disk drive. Performance is equal to that of the existing Z-2 and there is plenty of room in the cabinet to accommodate the addi-

tional drives. Carefully cutting and mounting the additional drives leaves an attractive, original equipment look to the Z-2 computer. If the existing five-inch disk drive is satisfactory except that you need more disk storage space, this solution will probably be the cheapest of all alternatives. Be certain to remove the resistor termination packs on all but the last drive

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The International Association of Cromemco Users is designed to provide its Members with the information they want. Help us deliver by answering the following questions. You may check more than one block as applicable: **My field is:**

- | | |
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| () Professional Services
<small>Accounting, Dentist, Law, Medicine</small> | () Engineer _____
<small>(Indicate specialty)</small> |
| () Other _____ | () Home Use |
| () Wholesaler or Distributor | () Retail Business |
| () Educational Institution | () Government |
- (Indicate level) (Indicate branch)

My Primary Uses are: () Personal Only
() Business () Process Control
() Business & Personal () Other _____
() Educational
() OEM _____

I am interested in:
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() Hardware () Other _____

I Want to Know More About the following Packages: () Home Economics
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() Educational (adult) () Process Control
() Educational (child) () Sports & Games
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Describe Your Present System: (use brands and model numbers)

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List Software Now in Use: (Packages, Special Operating Systems, etc.)

What Types of Software Would You Like to know more about?

Would you be interested in preparing an article of interest to our members?

☐ Yes
Subject Matter _____

Track Your Investments with COBOL Program Continued from first page

as a System Analyst on much larger IBM systems, that most development and maintenance projects in my field are done in COBOL. The complexity of programming in COBOL depends on user requirements. COBOL (COmmon Business Oriented Language) is a high-level language that is especially efficient in processing business applications which usually involve little algebraic or logical processing. COBOL emphasizes the description and handling of large volumes of input/output records.

I had been looking for a micro computer for about two years prior to buying my Cromemco Z-2H back in November, 1979. It took that long to find a machine with reasonable amount of RAM, COBOL (since I knew this language well), and plenty of disk storage at a reasonable cost. Cromemco's introduction of the Winchester disk drive offering over 10 megabytes of online storage, plus two 5 inch floppies and expandable RAM (to 512K) in such a small package and COBOL availability was just what I needed to apply some of my COBOL programming skills for my own personal use. Applications currently in development are COOKBOOK as a kitchen aid to menu preparation, freezer inventory, favorite recipes, and grocery lists; TVGUIDE to maintain a catalog of all movies on VTR tapes with running times, credits, type of movie, and related information; TAPELIB which maintains over 5000 different musical selections, all categorized into tape number, sequence, side, musical category (eg. folk, easy listening, disco), artist, and song or LP titles; and the SECURITIES MARKET SERIES programs featuring full menu-driven, user inter-action data-entry of Stock Market related information for portfolios, stocks, DOW-JONES averages to achieve selected issues charts, volumes, 200-day-averages, highs, lows, advances, declines, and other Stock-Market variables all at my fingertips. This article will feature an early version of STKADD program in the SECURITIES MARKET SERIES software.

As is the subject of this article, this program is written in COBOL to run on a Cromemco Z-2H micro computer. My purpose is not to try to teach you a new language, but to demonstrate the ease with which this language is read and to alert you that COBOL is available for use on micros. Many manufacturers and software houses are now making this language available. With minor changes and a simple I/O driver for your terminal, this same program could run on any CP/M compatible systems.

ABOUT THE PROGRAM

The program uses Cromemco's COBOL-80 version 3.22, which is equivalent to Microsoft's COBOL-80, with the exception of price. Both feature some or all Level 1 and 2 of the standard approved COBOL set. The ACCEPT and DISPLAY statement formats of this release makes it exceptionally easy to program routine data-entry programs for full cursor control of your terminal. The program is strictly one of data-entry and editing of data to set up the vast information you may choose to output at a later date. The user can select

many options with this program such as restarting anywhere within a selection of user defined stocks and automatic generation of repetitive data when in the tabled mode. Other options include automatic editing of numeric data and free-form number, fraction or decimal entry for automatic number-decimal conversion of stock prices. A special subroutine takes care of all stock price conversions to its equivalent number-decimal notation. The subroutine 'EDTPRICE' is not included in this article, but is available upon request. Certain guidelines are advised when abbreviated fraction formats are used. The main purpose of abbreviated formats is to save keystrokes.

All the informational data required for this program is readily available from various newspapers, journals or publications. For those requiring only weekly data, a weekly stock listing is all you will need.

THE STRUCTURE OF ALL COBOL PROGRAMS

Every COBOL program is divided into four divisions, each of which must be placed in its proper sequence, and each must begin with a division header. These four divisions and their functions are: IDENTIFICATION, ENVIRONMENT, DATA and PROCEDURE DIVISIONS. The IDENTIFICATION DIVISION names the program and optionally, the date the program was written and compiled, the author and other documentary information. The ENVIRONMENT DIVISION describes the computer to be used and specifies the special machine features used by this program and a description of the relationship of data with the actual input/output device. The DATA DIVISION defines the data with its characteristics used by the program whether in the input/output processing or data developed for internal program use. The PROCEDURE DIVISION consists of executable statements to process the data in the order as written unless some other order has been specified.

COBOL ANALYSIS OF STKADD

With the structure of COBOL behind us, let's analyze the program STKADD.

The SELECT statement (lines 13-15) is worthy of note. This statement defines the input/output file(s), which in this case is assigned to a disk drive (IN-DRIVE 'C:' of line 124). A printer may also be assigned, but for output only. The file is sequential, and each line (record) is terminated by a carriage-return (cr) making it variable rather than a fixed format. The maximum record length is 79 (line 22) characters. The SELECT is tied in with the FD (abbreviation for File Definition) statement (lines 19-22) which specifies the name of the file by the 'VALUE OF FILE-ID' clause, and the data-name 'STOCK-INPUT-NAME' referenced on line 20 points to the actual file name as found on lines 123-126. We will see later that this file-name is the default; that is, it may be any other file-name of your choosing, but I will discuss this later.

The WORKING-STORAGE section defines the different fields and attributes generated or used in the program. Note the COPY statements (line 31 and 47)

Track Your Investments with COBOL Program

which allows previously defined program code to be included into this program through the use of an external file. The file-name C:STOCKINP.CBK (line 31) contains the code lines 32 through 45, which defines the record format. A similar statement is on line 47, C:STKTABLE.CBK is the name of the file containing lines 48 through 101. These lines are actually a table containing a pre-defined set of stock-symbols and descriptions for stocks I wish to follow on a regular basis. Already tabled in the program is the DOW 30 stocks plus BALLY MFG. The table is similar to BASIC's matrixes and in this case is a 1220 dimensional table (occurs 120 / line 99). The table is limited to 120 tabled entries since no group of data (STOCK-TABLE / line 48) can be greater than 4095 bytes. Each table element is 34 bytes (8 bytes for the STOCK-SYMBOL and 26 characters for the STOCK-DESCRIPTION). There are, however, ways to get around this limitation, but these alternate procedures will not be discussed in this article.

Reading through the remainder of the WORKING-STORAGE section, you can see the use of various switches and other data-names used by the program. The context of most are easily understood by the use of meaningful data-names. The MASTER-FILE-IN-STATUS (Lines 119-122) is tied to the SELECT statement by the FILE-STATUS clause on line 15. Its purpose is to set various values to line 119 while in the process of opening, reading and writing the referenced file (all I/O operations). The '88' levels below line 109 are called conditional-names. These conditional-names have a specific value assigned to them that you can use for logical operations in a comparison test. Instead of saying "PERFORM MAIN-DRIVER UNTIL STOCK-TABLE-SWITCH EQUAL 'E'," for example, you can use the conditional-name assigned to the value 'E', such as "PERFORM MAIN-DRIVER UNTIL USER-DONE". This line sample is on line 139 in the program listed. Conditional-names cannot be altered; they are used for referencing only. Since you cannot change the values of conditional-names how does one alter the contents of the data/conditional-name? By changing the value of the

Easy Keying of Stock Market Data with STKADD

This program is geared to the Stock Market enthusiast who has no automatic way of entering market related data into the computer via telephone hook-up or use of other sources where data is available, but at a greater expense than doing it yourself. The purpose of STKADD program is to allow you to enter HIGH, LOW, CLOSE, DATE, VOLUME, and SYMBOL on a regular basis with so much ease as to make a monotonous task automatic. Any stock, even if outside the 120 table elements, may be tracked for input by this program. All you will need is a stock listing. Following about 31 stocks, such as are in the STKADD table, requires at most twenty minutes daily.

data-name above the 88 levels. This can be done by a MOVE statement to the data-name. Reading data into the data-name can also change its contents.

THE COBOL PROCEDURE DIVISION

In the PROCEDURE DIVISION are specific instructions to the computer to do something. All instructions are executed in the order as written, from top to bottom, unless the programmer has specified a different sequence by the use of a PERFORM or GO TO statement.

This release of COBOL (3.22) allows user inter-action with the terminal for all required data by special DISPLAY and ACCEPT verbs. DISPLAYs actually print the data or literal on the terminal screen, while the numbers enclosed in parenthesis, immediately following the word DISPLAY (or ACCEPT), indicate the line and columns (in that order) where the data will be printed on the terminal. The DISPLAY (1 1) ERASE (line 130, 138, 164) clears the screen from the very first line and column to the end of the screen (line 24 column 80), subsequent displays vary the cursor position before the data-name or literal is printed. A sample of a literal is in quotes in line 131 while a sample of a data-name (without quotes) display is on line 182 where the data-name is SECURITY-SYMBOL. ACCEPT statements function as the DISPLAY with regard to cursor positioning; however, the program waits for your data or reply to be entered through the keyboard before continuing with the next instruction.

The limitation of how many characters you can enter depends on the length of the data-name that was defined, but what you enter depends solely on what has been programmed in the instruction.

In brief, if you look at line 40 for data-name SECURITY-SYMBOL, you will see a PIC X(8) which means eight alphanumeric (X) characters. The ACCEPT on line 197 for this data-name would allow up to, but not more than, eight (8) characters to be entered. A similar PIC 9(6) TRADE-DATE (line 35) specifies numeric values only (the 9) for six positions. The 'V' imbedded in the PIC clause (line 41-43) points to the decimal point location, but not the physical decimal character itself. This allows numeric data to be properly aligned on the decimal point.

The PERFORM statement (equivalent to the GOSUB in BASIC) is used to branch to a paragraph-name which follows the word 'PERFORM' which then returns to the next statement after the branch (paragraph named) is done. Loops can be manipulated with a PERFORM through the use of counters, indexes or conjunctions such as UNTIL... or VARYING...FROM 1 BY 1 UNTIL. These are similar to BASIC FOR I TO... NEXT, etc. A 'GO TO' statement in COBOL works the same as in BASIC, that is you do an unconditional branch to another paragraph but does not return to the next statement after the GO TO. Basically, the GO TO and PERFORM statements control the program flow. Many variations of these statements allow looping, branching, and may be either conditional (if... PERFORM/GO TO) or unconditional.

The move statement in the PROCEDURE DIVISION of

a COBOL program allows movement of data, records, fields or literals (the from field) to any other data area within the DATA DIVISION (the to field). The length of the MOVE(d) field is determined by the length of the sending (to) field. All moves are from left to right unless the data-name is numeric, in which case the move is from right to left and aligns on the decimal if specified.

The IF statement is used for logical tests to determine if a special routine or function is to be done. IF statements may even be nested as on lines 147 through 160.

To retrieve or store information in a table requires the use of an INDEX-NAME (or subscripts) to point to a particular element in a table. The SET statement is used to update the contents of an INDEX-NAME with either an up or down movement or a specific numeric value. INDEX-NAMES are commonly used to manipulate tables and are normally defined at the time the table is defined. A sample INDEX-NAME is STK-TBL-INDEX line 99, and is part of the INDEXED BY clause.

I mentioned briefly about the file-name default and that the file-name may be any file-name of your choosing. If you look at lines 134-135 you will find an ACCEPT statement for the data-name STOCK-INPUT-NAME. I will break this statement down to its optional components and explain what this ACCEPT allows you to do. The ACCEPT along with the cursor positioning feature have already been discussed. The data-name STOCK-INPUT-NAME currently contains C:STKINPUT.DAT (lines 123-126) and the UPDATE option allows the contents of STOCK-INPUT-NAME (C:STKINPUT.DAT) to be displayed (as default) and changed if required. The AUTO-SKIP option allows automatic termination of this command once all characters of the specified data-name are filled in (length of STOCK-INPUT-NAME is 14 bytes). The PROMPT option allows prompting (user interaction), while the BEEP allows the terminal, if so equipped, to make an audible sound.

Another point of interest in this program is the CALL statement (line 284). This functions as in BASIC, to "call" in another program or subroutine from the program currently residing in memory. To call a subroutine you issue a CALL via a "call" statement, followed by the subroutine ('EDTPRICE' in this sample) then the word USING (if parameters are required) followed by the required parameters in the sequence necessary for the subroutine. To function, this subroutine 'EDTPRICE' requires three parameter values to be passed to it, the input (EDIT-IN), the output from the subroutine (EDIT-OUT) and a status code field (ERROR-CODE). The length of each field must be the same in both the calling (STKADD) and the called (EDTPRICE) program, the data-names, however, need not be the same. The subroutines main function is to take any mixture of whole numbers and decimals or fractions and spaces to arrive at a converted whole number decimal combination. The resulting decimal is to a five point accuracy, which is plenty for any market related price information. 10½ or 10.5 or 10 5 or 10-4 into the subroutine 'EDTPRICE' will return with the value 00001050000

with the decimal point assumed prior to the 5 (see EDIT-OUT line 26). This may seem easy or trivial, but as you are keying your information, you don't want to have to convert fractions to a fixed format decimal prior to keying the information since it would slow you down. The micro can do these with ease. What's the decimal equivalent of 1/32? Let the machine worry about it. The built in limitation to this subroutine is that the whole number must not exceed 999999 (the 9(6)). Other restrictions are in the special meaning of the dash, slash, asterisk, the 'T' and space which follow the whole number. The dash (—) means the following number is divided by 8, the number following the asterisk (*) is divisible by 16 and the 'T' means the number is divisible by 32. A fraction may also be entered, such as 1/8, but it must follow the whole number by one(1) blank character. A decimal number may be used the same as you would use a dollar and cent figure, the decimal point itself may be omitted (is optional). All these techniques were programmed to eliminate the keystrokes that were mostly repetitive in nature, such as the denominator portion of the fraction.

MORE LESSONS IN COBOL IN FUTURE ISSUES

I have used very meaningful names in this program so as to be self documenting, especially for those who understand the language of the market. More programs in the SECURITIES-MARKET-SERIES, not covered here, will utilize all the price data you can give it through this program, to create various charts, and volume or price related indicators in just about any way you want. All other programs in this series will require a record format such as revealed in this program. Future articles will give you further glimpses into the capabilities of COBOL.



About the Author

PETER J. POLINI (Owner of PJP Associates / DBA)

Pete got his start with computers in 1969 when he started work for P.C. Service Corp. a subsidiary of the Pacific Stock Exchange. Since then, he has written and maintained hundreds of programs (mostly COBOL) running on large IBM mainframes. So when he decided on his first computer, it simply had to run with COBOL. He purchased the 32K STRUCTURED BASIC and the Z80 MACRO ASSEMBLER and tried his hand with them, but he decided that with the COBOL expertise behind him, he could concentrate on developing maintainable and easy to use COBOL programs for his micro. From his previous experiences with COBOL, the transition of writing programs from big computers to the Cromemco Z 2H was quite easy.

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He has since written many programs (all in COBOL) to run on the Z 2H most of which are related to the stock market.

Pete is currently interested in forming a users group in the Beverly Hills or West Los Angeles area for stock market enthusiasts who have modem capability. This chapter will feature real time stock market related data and software exchange privileges to its members for a fixed monthly fee plus individualized software development and support at nominal rates. Interested members should contact the editor of I/O News giving a brief description of computer and hardware configuration operating system and areas of interest and expertise.

As owner of PJP ASSOCIATES, Pete caters to writing user customized COBOL programs for the Cromemco family of computers running under CDOS. By mid year he will be able to support CROM X users also.

Pete is employed as a Senior System Analyst for a major California Savings & Loan as a project leader. He is also available for speaking engagements to other users groups interested in the COBOL programming language.

```

1  IDENTIFICATION DIVISION.
2  PROGRAM-ID.      STKADD.
3  AUTHOR.          PETER J POLINI.
4  DATE-WRITTEN.    MAY 1980.
5  ENVIRONMENT DIVISION.
6  CONFIGURATION SECTION.
7  SOURCE-COMPUTER. CROMEMCO Z-2H.
8  OBJECT-COMPUTER. CROMEMCO Z-2H.
9                      MEMORY SIZE 65536 CHARACTERS.

10 INPUT-OUTPUT SECTION.
11 FILE-CONTROL.
12     SELECT MASTER-FILE-IN ASSIGN TO DISK
13     ORGANIZATION IS LINE SEQUENTIAL
14     FILE STATUS MASTER-FILE-IN-STATUS.
15
16 DATA DIVISION.
17
18 FILE SECTION.
19 FD MASTER-FILE-IN
20   VALUE OF FILE-# STOCK-INPUT-NAME
21   LABEL RECORD STANDARD.
22 DT MASTER-IN-RECORD          PIC X(79).
23
24 WORKING-STORAGE SECTION.
25 77 EDIT-IN                  PIC X(12).
26 77 EDIT-OUT                 PIC X(12).
27 77 ERROR-CODE               PIC X.
28 88 VALID-RETURN-CODE        VALUE '1'.
29 88 EDITPRICE-RETURN-ERRNO   VALUE 'E'.
30
31 COPY F TO X MP CODE
32 DT STOCK-INPUT-RECORD.
33 10 RECORDS-#               PIC X(3).
34 88 STOCK-FORMAT            VALUE 'STR'.
35 10 TRADE-DATE              PIC X(6).
36 10 SETTLEMENT-DATE         REDEFINES TRADE DATE.
37 15 TRADE-MONTH             PIC X(2).
38 15 TRADE-DAY               PIC X(2).
39 15 TRADE-YEAR              PIC X(2).
40 10 SECURITY-SYMBOL          PIC X(8).
41 10 HIGH                    PIC X(4) VALUE '9'.
42 10 LOW                     PIC X(4) VALUE '5'.
43 10 CLOSING                 PIC X(4) VALUE '5'.
44 10 STOCK-VOLUME            PIC X(4).
45 10 FILLER                  PLS X(2).
46
47 COPY C;STKTABLE.COK.
48 DT STK-TABLE.
49 10 F PIC X(34) VALUE 'ACD'    ALLIED CHEMICAL
50 10 F PIC X(34) VALUE 'AA'     ALUMINUM CO. OF AMERICA
51 10 F PIC X(34) VALUE 'AMB'    AMERICAN BRANDS
52 10 F PIC X(34) VALUE 'AC'     AMERICAN CAN
53 10 F PIC X(34) VALUE 'AT'     AMERICAN TELEPHONE
54 10 F PIC X(34) VALUE 'BLY'    BALLY MFG
55 10 F PIC X(34) VALUE 'BS'     BETHLEHEM STEEL
56 10 F PIC X(34) VALUE 'BD'     BU DON
57 10 F PIC X(34) VALUE 'ER'     EASTMAN KODAK
58 10 F PIC X(34) VALUE 'EXON'   EXXON
59 10 F PIC X(34) VALUE 'GE'     GENERAL ELECTRIC
60 10 F PIC X(34) VALUE 'GF'     GENERAL FOODS
61 10 F PIC X(34) VALUE 'GM'     GENERAL MOTORS
62 10 F PIC X(34) VALUE 'GT'     GORDIAN
63 10 F PIC X(34) VALUE 'IH'     IHCO
64 10 F PIC X(34) VALUE 'IBM'    INTERNATIONAL BUSINESS MACHINES
65 10 F PIC X(34) VALUE 'HR'     INTNL HARVESTER
66 10 F PIC X(34) VALUE 'IP'     INTNL PAPER
67 10 F PIC X(34) VALUE 'JM'     JOHN MANVILLE
68 10 F PIC X(34) VALUE 'MK'     MERCK & CO
69 10 F PIC X(34) VALUE 'MMH'    MINNESOTA MINING & MFG
70 10 F PIC X(34) VALUE 'OI'     OWENS ILLINOIS
71 10 F PIC X(34) VALUE 'PG'     PROCTER & GAMBLE
72 10 F PIC X(34) VALUE 'S'      SEARS, ROEBUCK & CO
73 10 F PIC X(34) VALUE 'SO'     STANDARD OIL OF CALIF
74 10 F PIC X(34) VALUE 'TX'     TEXACO INC
75 10 F PIC X(34) VALUE 'UK'     UNION CARBIDE
76 10 F PIC X(34) VALUE 'US'     US STEEL
77 10 F PIC X(34) VALUE 'UTV'    UNITED TECHNOLOGIES
78 10 F PIC X(34) VALUE 'WB'    WESTINGHOUSE ELECTRIC
79 10 F PIC X(34) VALUE 'Z'      WOOLWORTH, (F N)
80 10 F PIC X(34) VALUE HIGH-VALUES.
81 10 F PIC X(34) VALUE HIGH-VALUES.
82 10 F PIC X(34) VALUE HIGH-VALUES.
83 10 F PIC X(34) VALUE HIGH-VALUES.
84 10 F PIC X(34) VALUE HIGH-VALUES.

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85 10 F PIC X(34) VALUE HIGH-VALUES.
86 10 F PIC X(34) VALUE HIGH-VALUES.
87 10 F PIC X(34) VALUE HIGH-VALUES.
88 10 F PIC X(34) VALUE HIGH-VALUES.
89 10 F PIC X(34) VALUE HIGH-VALUES.
90 10 F PIC X(34) VALUE HIGH-VALUES.
91 10 F PIC X(34) VALUE HIGH-VALUES.
92 10 F PIC X(34) VALUE HIGH-VALUES.
93 10 F PIC X(34) VALUE HIGH-VALUES.
94 10 F PIC X(34) VALUE HIGH-VALUES.
95 10 F PIC X(34) VALUE HIGH-VALUES.
96 10 F PIC X(34) VALUE HIGH-VALUES.
97 10 F PIC X(34) VALUE HIGH-VALUES.
98 10 F PIC X(34) VALUE HIGH-VALUES.
99 10 F PIC X(34) VALUE HIGH-VALUES.
100 10 F PIC X(34) VALUE HIGH-VALUES.

01 STOCK SELECTION REDEFINES STOCK-TABLE.
10 ONE-STOCK DECLRS 120 INDEXED BY STK-TBL-INDEX.
15 STOCK-SYMBOL      PIC X(8).
15 STOCK-DESCRIPTION PIC X(26).

01 CONTROL-AREA.
10 STOCK-HIGH        PIC X(12).
10 STOCK-LOW         PIC X(12).
10 STOCK-CLOSE       PIC X(12).

01 CONTROL-AREAS.
10 STOCK-TABLE-SWITCH PIC X VALUE '1'.
88 STOCK-TABLE-IN-USE  VALUE '1'.
88 STOCK-TABLE-RESTARTING VALUE '2'.
88 STOCK-TABLE-INDT-FOUND VALUE '3'.
88 USER-DONE          VALUE 'E'.

10 MENU-TYPE          PIC X.
88 RESTART-YES        VALUE 'Y'.
10 RESTART-SYMBOL     PIC X(8) VALUE SPACES.
10 STOCK-CARDS-IN     PIC X(3) VALUE ZEROS.
10 MASTER-FILE-IN-STATUS PIC X VALUE '00'.
88 MASTER-FILE-IN-EOF  VALUE '10'.
88 MASTER-FILE-NOT-OPEN VALUE '00'.
88 MASTER-DID-OPEN     VALUE '00'.

10 STOCK-INPUT-NAME.
15 IN-DRIVE           PIC X(8) VALUE 'C:'.
15 IN-NAME            PIC X(8) VALUE 'STKINPIT'.
15 IN-EXT             PIC X(3) VALUE '.DAT'.

PROCEDURE DIVISION.
10 DISPLAY (1 1) ERASE.
10 DISPLAY (2 10) '*** STKADD MENU VERSION 80.310 ***'.
10 SPLAY (3 10) '***ALL RIGHTS RESERVED...PJP ASSOCIATES***'.
10 DISPLAY (4 10) 'FOUR FILE NAME IS >>>>>' .
10 ACCEPT (4 30) STOCK-INPUT-NAME WITH PROMPT
10 UPDATE AUTO-SKIP BEEP.

10 MOVE SPACES TO STOCK-INPUT-RECORD.
10 OPEN EXTEND MASTER-FILE-IN.
10 DISPLAY (1 1) ERASE.
10 PERFORM MAIN-DRIVER UNTIL USER-DONE.
10 IF NOT MASTER-FILE-NOT-OPEN
10 CLOSE MASTER-FILE-IN.
10 STOP RUN.

10 SET STK-TBL-INDEX TO
10 PERFORM DISPLAY+TABLE-BYPASS.

10 PERFORM DISPLAY-END-OR-CONTINUE
10 IF END-RUN NEXT SENTENCE

10 PERFORM DISPLAY-MENU.

10 PERFORM DISPLAY-RESTART.
10 MOVE SPACE TO STOCK-TABLE-SWITCH
10 IF NOT RESTART-YES
10 PERFORM GET-RESTART-SYMBOL
10 IF STOCK-TABLE-RESTARTING
10 PERFORM STOCK-TABLE-MAIN-LINE.

10 MOVE '1' TO STOCK-TABLE-SWITCH.
10 DISPLAY (1 1) ERASE.
10 DISPLAY (10 15) 'TRADE DATE MMDDYY'.
10 ACCEPT (10 3) TRADE-DATE WITH PROMPT
10 AUTO-SKIP ZERO-FILL.

10 VARYING STK-TBL-INDEX FROM STK-TBL-INDEX BY 1
10 UNTIL STK-TBL-INDEX GREATER 120
10 OR STOCK-SYMBOL (STK-TBL-INDEX) = HIGH-VALUES.
10 MOVE '1' TO STOCK-TABLE-SWITCH.

10 DISPLAY (1 1) ERASE.
10 DISPLAY (2 1) 'TYPE IN REQUESTED INFORMATION'
10 '--- RECORDS ADDED & STOCK-CARDS-IN.
10 DISPLAY (10 15) 'TRADE DATE MMDDYY'.
10 IF STOCK-TABLE-IN-USE
10 DISPLAY (10 3) TRADE-DATE
10 MOVE STOCK-SYMBOL (STK-TBL-INDEX) TO SECURITY-SYMBOL.
10 DISPLAY (11 3) SECURITY-SYMBOL
10 DISPLAY (11 15) STOCK-DESCRIPTION (STK-TBL-INDEX)
10 DISPLAY (11 15) 'SECURITY SYMBOL MAX 8 CHARACTERS'.
10 DISPLAY (12 18) 'VOLUME IN 100S LIMIT 9999999'.
10 DISPLAY (13 18) 'HIGH -FORMAT WHOLE NUMBER'
10 '--- PERIOD (.) FOLLOWED BY'.
10 DISPLAY (14 35) 'DECIMAL ON FRACTION'
10 'MAX VALUE 99999.99999'.
10 DISPLAY (15 20) 'HIT RETURN KEY CDS WHEN DONE'.
10 DISPLAY (16 18) 'LOW -FORMAT SAME AS ABOVE'.
10 DISPLAY (17 18) 'CLOSE -FORMAT SAME AS ABOVE'.
10 IF NOT STOCK-TABLE-IN-USE
10 ACCEPT (10 3) TRADE-DATE WITH PROMPT BEEP
10 ACCEPT (11 3) SECURITY-SYMBOL WITH PROMPT SPACE-FILL.
10 ACCEPT (12 3) STOCK-VOLUME WITH PROMPT
10 ACCEPT (13 3) STOCK-HIGH WITH PROMPT SPACE-FILL.
10 ACCEPT (16 3) STOCK-LOW WITH PROMPT SPACE-FILL.
10 ACCEPT (17 3) STOCK-CLOSE WITH PROMPT SPACE-FILL.

10 DISPLAY (20 5) 'TYPE IN'.
10 DISPLAY (21 10) 'O OR E TO RETYPE LAST TRANSACTION'.
10 DISPLAY (22 10) 'HIT ANY OTHER KEY TO CONTINUE'.

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Track Your Investments with COBOL Program

SCHEM 4

Applicable only if in table-mode and a reenter (REENTER) was requested.
Allows entering of stock symbols from table selection for reentering.

2008年 5

Also allows correction in case an error has been made; RECORDS ADDED is a count of valid entries added to input file

SOUTH 1

Applicable when in the table-mode. Allows data to be used for subsequent tabled entries.

SCHEM 7

Allows termination of BTXADD and to return to the operating system

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SCANNED BY

Aligns AXI1 from the table-mode.

COMANDER I

COMposition of Artwork aNd Document Editing and Report Generation System

By Jim Blum

ABSTRACT

A combined text and graphics color composition system called COMANDER I is discussed which enables a user to compose and edit brochures, presentations, and documents which include all of the artwork (illustrations, graphs, figures, etc.) eliminating separately generated artwork which must be cut and pasted onto the hardcopy. Complete page makeup with user-defined fonts and graphic aids, all in color, enable a complete novice to do both text processing and graphic design entirely on the system.

A minimum system will be aimed at the \$20,000 range (or under if possible) and will be a floppy disk based system with a black and white dot graphics printer such as the MALIBU printer. Various hardware options will be supported such as color printers, color plotters, hard disks, NTSC output for devices such as ordinary TV and video tape, image digitizers for cameras, etc. The internal data structures of COMANDER I will not be discussed, as they are still being optimized for minimum memory space, maximum speed, and flexibility, at the time of this writing. Instead, an overview from the user end will be discussed. The system is still in development with general release planned second quarter of 1981.

The user interface is not a procedural language, nor are there embedded commands in the data for output processing. Instead, a highly interactive user interface is achieved through the use of a hierarchical set of user commands with prompts at each level, and through the use of a graphics tablet made by Summagraphics called a BITPAD to give the user a means of pointing directly at the area on the screen to be composed or edited. Immediate screen formatting is performed when a command is entered, enabling the user to see exactly how it will appear on the final copy. This allows color slides and video tape to be made directly from the system for brochures, presentations, or instructional courses. For TV broadcast applications the system may be used as a character generator for titlers and teletext, but in addition can be used for generating pictorial graphics for commercials and animation.

The software is written by the author in PASCAL, and runs on a CROMEMCO microcomputer system.

SYSTEM HARDWARE

COMANDER I currently runs on a CROMEMCO Z80,

S100-bus microcomputer with two floppy disks, 64K bytes of program memory, and the Super Dazzler graphics boards (SDI) made by CROMEMCO with resolution of 756 horizontal by 482 vertical in two-color high resolution mode, and 378 horizontal by 241 vertical in sixteen-color medium resolution mode. Any two colors in high resolution mode, or any sixteen colors in medium resolution mode out of 4096 colors may be displayed simultaneously on the screen. Medium and high resolution areas may be displayed simultaneously on the screen. A set of registers in the SDI called the colormap containing sixteen 12-bit words is used to achieve the wide range of colors. A special two-port 48K byte memory board made by CROMEMCO is used to refresh the screen. One of the ports on the memory board is used by the SDI to directly refresh the screen and is accessed through a ribbon cable directly connected from the SDI to the memory. IE, this port is not connected to the main bus, and eliminates bus contention. Without this separate port, the required refresh would take up more than 90% of the bus bandwidth. The other port is connected to the main bus, and is used by the program to modify the refresh memory for changing the display. This is accomplished by bank switching the 48K memory board into the Z80 cpu address space. This means that the portion of the program which modifies the refresh memory must reside in the remaining 16K of address space.

In addition to the graphics hardware, a Summagraphics digitizer tablet called the BITPAD is used for inputting commands and data coordinates. It is connected to an RS-232 serial port in the system. An overlay is placed over the bottom of the BITPAD for command and symbol selection. The remaining area of the BITPAD corresponds to the area on the screen display. A stylus is connected to the BITPAD and is moved around on the BITPAD and generates coordinates to the program which is used to determine where on the BITPAD the user is pointing. In addition, the BITPAD sends a flag byte which indicates whether the stylus point is pushed down on the BITPAD or within the vicinity of the BITPAD. A crosshair cursor is displayed on the screen when the stylus is near the BITPAD and follows the movement of the stylus across the BITPAD to indicate to the user the point on the screen corresponding to the point on the BITPAD the stylus is near. The cursor disappears as soon as the

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stylus is pressed down on the BITPAD.

The display is currently an RGB monitor made by ALGOL which is a low cost monitor and is not actually designed to handle more than 300 horizontal lines of resolution, but is adequate for my development. A higher resolution RGB monitor is recommended for high resolution detail. Another alternative is to have an RGB to NTSC encoder (which I plan to have) and then display it on an ordinary TV. With a decent encoder (which I have seen), high resolution text and graphics are perfectly readable, and color hues are accurate. The encoder allows output to other video media such as video tape. Even though the NTSC format is limited in horizontal resolution, a smoothing effect (anti-aliasing) is achieved with adjacent pixels which are non orthogonal (not vertical or horizontal).

A standard CRT connected to an RS-232 port is used to bring up the system and can be used as the output device for command prompts, and can also be used as the input device instead of the BITPAD if desired. This is useful when exact coordinates are desired instead of visual coordinates on the screen. The BITPAD is much faster for interactive work, but the user can only approximate the desired location on the screen down to within 3 or 3 coordinates through visual inspection of the cursor location. With the CRT as the input device, X Y coordinates are entered as numbers.

Currently, a MALIBU printer with 60 x 72 dots per inch dot graphics capability is used as the hardcopy device. This provides adequate resolution for internal documents, or presentations, but is black and white only. Printacolor has announced an ink jet printer with 7 colors (plus white) which has a 100 x 100 dot resolution. Other color hardcopy devices are starting to become lower in cost and higher in speed and resolution for high quality and multi-color capability. The Printacolor printer will cost around \$6,000 and will be available sometime in 81 in production quantities I'm told.

IMPLEMENTATION SOFTWARE

At the time of this writing, the system runs under the UCSD operating system and is mostly written in PASCAL with some routines such as I/O, and a few other speed dependent routines written in Z80 assembly language. The software is being converted to run under CP/M* using the PASCAL MT+ compiler which generates native code. This will speed up the routines considerably. I also plan on making it run under CROMIX* if possible. CROMIX is CROMEMCO's UNIX* like new operating system. The PASCAL MT+ runtime package can also be made to interface to an AMD 9511 math chip to speed up integer, floating point, and transcendental operations; and will reduce the size of the arithmetic runtime support routines. This should speed up the scan conversion routines (3) considerably. I have ordered a new board from Godbout Electronics that has the logic and a socket for a 9511 (or 9512) chip, and I will purchase a 9511 chip from AMD. Hopefully, I will have it operational and have some benchmark statistics by the time this paper is presented.

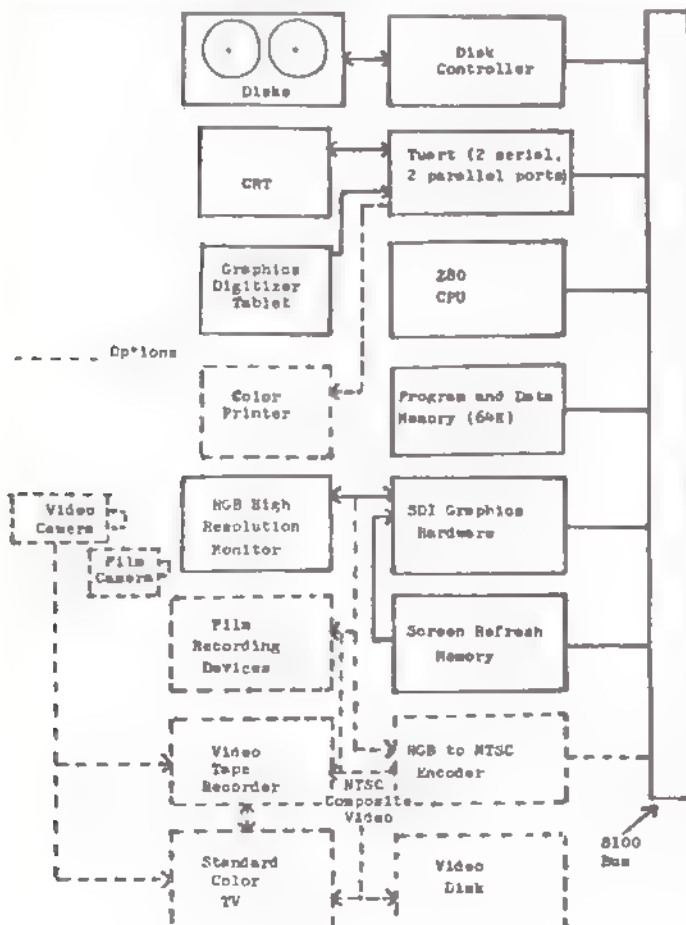
COMANDER I OVERVIEW

COMANDER I is a collection of ideas from the books, papers, and systems listed in the references, and many of my own ideas. The main orientation of COMANDER I is on "symbols".

Symbols

A symbol may be an alphanumeric character in any desired font, or any graphic symbol. COMANDER I makes no distinction between alphanumeric and graphic symbols. IE, a symbol is simply a collection of dots which may be placed anywhere on the screen and becomes part of the composition that the user is generating. Symbols may be inserted, deleted, moved, formatted, etc., similar to text in word processing systems. Symbols are created by the user and stored in symbol files for access. Each symbol file has a fixed cell box size which all of the symbols in the file must fit into. IE, if a box size of 16 is chosen for a symbol file, then no symbol in the file may have more than 16 horizontal or vertical dots in any one line. Currently, the cell box size choices are 4, 8, 12, 16, 24, 32, and 64. For obvious efficiency reasons, the user should choose the smallest box size that the largest symbol will fit into. For entering symbols into his composition, the user enters a symbol file name and then selects symbols using the overlay on the BITPAD. Each position on the

Figure 1




overlay corresponds to a symbol in the symbol file. When creating the symbols, the user picks a desired character on the overlay to represent the symbol, and then subsequent selection of this character will cause the desired symbol to be extracted from the symbol file and placed on the screen (and thus in his composition) at the desired location and color. In order to make the user's job of remembering which characters correspond to which symbols, he makes up his own overlay on a piece of paper and draws in the symbols at the selected positions and places the new overlay over the current one. So for every symbol file, an overlay should be used while that symbol file is being used. Symbol files containing various text font styles need not have a separate overlay since the normal overlay has the standard alphanumeric character set. The user should of course use the same characters on the overlay to represent the characters in the symbol files when defining a new font.

Defining new symbol files is not difficult, but somewhat time consuming. Some common symbol files will be supplied with the package, and I also plan on building up a library of standard and commonly used fonts and symbols through contributions from various users, and making them available to everyone. There is one built in character set in the program. To build a new symbol file or change or add new symbols to an existing symbol file, the "compile" command is selected, and a symbol file name is entered. If the file exists, it will be opened and the cell box size will be obtained from its associated definition file. If the file does not exist, it will be created, and the user will be asked to choose a cell box size from the available choices. The user is then prompted for a symbol to add or change, and a grid the size of the box size is displayed on the screen. The user has the choice of turning positions in the grid "on", "off", or "border." He then points to the squares to be changed, and when done selects the exit key. When done, he may choose to change another symbol, return back to the one he was working on, or end the symbol definition compiler command. The symbol file will be closed when he is done. To give the user visual feedback, squares in the grid which are "off" are alternately displayed in red and magenta; squares which are "on" are alternately displayed in blue and black; and "border" squares (see below) are green and cyan. In addition, the symbol is displayed in real size on the right side of the grid to allow visual inspection of the symbol as it is being created or changed.

Two different types of dots are stored in the symbol files. One type represents normal dots which are to be turned on in the selected color, and the other type represents a second color may be used as a border or shadow around the character and will be turned on in the second color selected. In the program, it is referred to as the border color, but may be used for any purpose.

Also stored in the symbol files, is the horizontal and vertical spacing desired for each symbol. This provides

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proportional spacing between characters and also provides information for left and right justification. This is called "glue" and the idea came from Knuth's Tex and Metafont system (2).

(See figure 3 for some examples of symbol files which have been defined.)

Drawing Aids

The user may choose not to use predefined symbols and simply "draw" (1) on the screen. Drawing may be done totally by the user by "painting" dots on the screen, or by specifying points and having the program generate lines and circles through these points. In either case, the "drawings" become part of the composition just like the symbols. A grid may be placed on the screen to aid the user in lining up points. In addition, any closed figure may be filled with a particular color. If the figure is not closed on all sides, the color will "leak" out through any holes in the figure.

Windows, Viewports, and Regions

Compositions are saved on disk files and are accessed via "windows" into the file. A file name is entered and a window then becomes associated with the composition to be created or edited. In order to view the composition through the window, a "viewport" must be defined on the screen. This is done by pointing to the top left corner and the bottom right corner of the screen (using the BITPAD stylus) for the desired viewport location on the screen, which determines the size of the window into the file. Once a window and viewport are defined, as much of the composition as will fit is displayed on the screen at the viewport loca-

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Figure 2

tion. If a new composition is being created, then a viewport background color is requested, and the viewport is filled with this color. A default palette of 16 colors displayed at the bottom of the screen is used as the palette associated with the file. However, all sixteen colors may be changed to any set of 16 out of 4096 colors, and will be used on any subsequent edit of the composition.

More than one viewport (and thus window into a composition file) may be located on the screen for multi-composition editing. Parts of one composition may be copied into another composition by simply positioning both windows to the desired locations in the compositions and pointing at the data to be copied.

Before any symbols or drawing may be entered into a new section of the composition, the user must define high or medium resolution areas in the window called "regions". Medium resolution has the advantage of 16 color choices, whereas high resolution is limited to 2 color choices. In high resolution mode, the individual dots (called "pixels") on the screen are one fourth the size of the medium resolution pixels. So the tradeoff is smaller pixel size versus more color choices. In addition, a background color for the region is selected by the user so that he can see just where these regions exist in the composition. If a high resolution region is selected then the background color is automatically selected, since only two colors may be used in this region. The color on the left side of the palette at the bottom of the screen is used as the background color, and the data takes on the color of the far right hand side of the palette. Unless, the user changes these colors, the background color is white, and the data color is black. For medium resolution regions, the user selects

any one of the 16 colors for the background, and data may be entered in any one of the 16 colors. The user can enter data in the background color, but the data will not be visible unless he turns off the background color or changes it. Background colors are normally used for outlining regions and windows, and not part of the data. If the user desires to photograph or output the data to video tape, or other devices, there are commands to make all of the backgrounds the same color, so that only the data appears to be there.

Once a region is defined, the user may enter symbols or draw in the region. In order to enter symbols, a symbol file name is entered; a position in the current region is selected, and for a medium resolution region, the main and border colors are selected. The position is selected by moving the BITPAD stylus until the crosshair cursor on the screen is at the desired point and then pushing the stylus down. The colors are selected by positioning the cursor in one of the palette boxes and again pushing the stylus down on the BITPAD. From then on, symbols are selected by pressing the stylus down in one of the overlay character boxes. A character box marked "ENTER" is used as a carriage return key in order to move the position down one line (whose height is determined in the symbol file) and back to the beginning horizontal position selected. Later, the ability to choose the direction (left, right, down, up) for symbols entered will be implemented. Default will be to the right if no direction is specified.

CURRENT USES OF THE SYSTEMS

So far I have used the system for producing my own stationery, and invoice forms with my company's logo on them using the Malibu printer (see figure 2). Various character fonts, plus some other symbol files have

Figure 3a
Roman Style Font

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m
n o p q r s t u v w x y z

Figure 3b
Electronic Logic Symbols



COMANDER I

been created using the symbol compiler (see figure 3). In addition to logos and business forms, the system can currently be used to generate brochures, presentations, illustrations, graphs, bar charts, broadcast video applications such as character generators for titlers and teletext, animation (single step frame generation), and commercials. Also, non-broadcast video applications such as training films and video tape can be made. Color slides or dot graphics printers can be used to capture the images on hard copy. At the time of this writing, many of the editing and formatting commands used in typical word processing systems have not yet been implemented. I hope to have enough implemented by the time this paper is presented in order to demonstrate it's practical use in the area of document preparation by generating the complete user manual for this system entirely from this system. Other uses include complete page layout for newspapers, magazines, etc.

UNDECIDED ISSUES

The biggest unknown at the time of this writing is what hardcopy devices will be supported. Ideally, I would like to find a low cost, high resolution, random position, dot matrix, color printer rather than vector pen plotters or fully formed character printers such as daisy wheel printers. The reasons for this are: the system is currently dot oriented and not vector or fully formed character oriented. Fully formed character printers are limited to the character fonts supplied with the printers, and plotters are typically slower and require a lot of paper fiddling. However, pen plotters can produce a very high quality, multicolor output at a reasonable cost. For brochures, user manuals, etc., high quality hardcopy is a must. For quick presentations or internal documentation, faster dot matrix printers are preferable. One attractive color dot matrix printer is the Printacolor Ink jet printer which I have been told will sell for around \$6,000 and will be available sometime in mid 81, and provides 7 colors (plus white) with resolution of approximately 100 dots per inch, and prints at approximately 70 chars/second. For black and white the VERSATEC V80 printer looks very attractive for \$8500. It has 200 dots per inch resolution and can plot dot graphics at 1 inch per second. In normal print mode it can print at 1000 lines per minute using the built-in fonts. It is an electrostatic printer and the paper costs around \$37 for a box of 1000 fan-fold 11-inch sheets. However, I don't know of any \$100 bus controller for it. I expect there will be (or currently in the works) printers which will be coming out at lower costs, and higher quality later this year. At this time I will be supporting the Malibu black and white dot matrix printer which provides dot graphics, and am postponing the decision for other hardcopy devices until later when more become available. I would like to avoid the typesetter alternative, as they are too expensive, and I believe will eventually be replaced by other hardcopy devices such as xerographic or laser printer devices, or possibly a direct interface to a plate making device for large volume copying, eliminating the typesetter altogether.

FOOTNOTES

- *UNIX is a trademark of Bell Laboratories
- *CP/M is a trademark of Digital Research, Inc.
- *CROMIX is a trademark of CROMEMCO, Inc.

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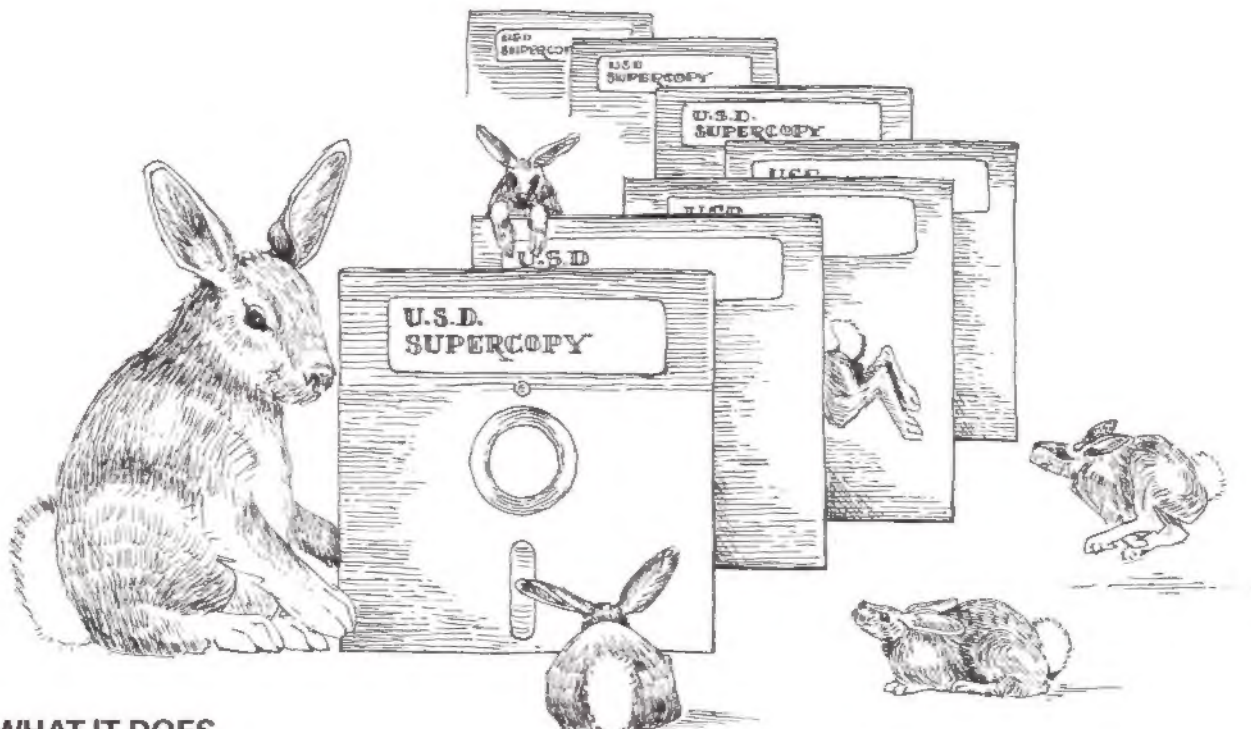


About the Author

JIM BLUM is an Engineering Development Systems Manager at a division of TRW. He has also started his own company called COMAGRAPH, an acronym for Computer Automated Graphics and Text Processing. He has been in the computer field for over 13 years mainly in the area of systems software. He presented a paper at the 1980 Computer Faire in San Francisco entitled "ANIMAL — An Animation Language used in Creating Animated Scenes in Color on a Personal Computer" which was an experiment in the area of computer animation to see what could be accomplished on an inexpensive computer system using PASCAL as the implementation language. Since the writing of his paper his work has evolved more into the complete spectrum of computer generated visual systems, all the way from documentation preparation with total graphics and hard copy capability, to live-action presentations using video tape to store the computer generated images, mixed with optional video camera input and audio dubbing. At COMAGRAPH he is writing software for reliable and inexpensive OEM computer and video hardware to produce a complete family of products for document processing with complete graphics capability, broadcast and non-broadcast video applications, and computer generated visual systems for presentations and instructional courses using video tape, film, etc.

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